







ANATOMY IN A NUTSHELL

LAUGHLIN

(Second Edition.)

Poor Humanty.

The following poetry was found in the pocketbook of the late G. H. Laughlin.

More than half a century since the following lines were found in the Royal College of Surgeons, London, beside a skeleton, remarkable for its symmetry of form. They were subsequently published in the London Morning Chronicle, and a vain effort made to ascertain the author, even offering a reward of fifty guineas.

I.

Behold this ruin! 'Twas a skull
Once of ethereal spirit full.
This narrow cell was Life's retreat,
This space was Thought's mysterious seat.
What beauteous visions filled this spot
With dreams of pleasures long forgot!
Nor hope, nor joy, nor love, nor fear,
Have left one trace of record here.

II.

Beneath this moulding canopy
Once shone the bright and busy eye.
But start not at the dismal void!
If social love that eye employed;
If with no lawless fire it gleamed,
But through the dews of kindness beamed,
That eye shall be forever bright
When sun and stars are sunk in night.

III.

Within this hollow cavern hung
The ready, swift and tuneful tongue.
If Falsehood's honey it disdained,
And when it could not praise was chained;
If bold in Virtue's cause it spoke,
Yet gentle concord never broke—
That silent tongue shall plead for thee,
When time unveils eternity!

IV.

Say, did these fingers delve the mine,
Or with the envied ruby shine?
To hew the rock or wear the gem,
Can little now avail to them.
But if the page of truth they sought,
Or comfort to the mourner brought—
These hands a richer meed shall claim
Than all who wait on Weal or Fame.

V.

Avails it whether bare or shod,
These feet the path of duty trod?
If from the bowers of ease they fled,
To seek Affliction's humble shed;
If Grandeur's guilty bribe they Spurned,
And home to Virtue's cot returned—
These feet with angel's wings shall vie,
And tread the palace of the skies.

ANONYMOUS

ANATOMY IN A NUTSHELL

A TREATISE ON HUMAN ANATOMY
IN ITS RELATION TO OSTEOPATHY

↓
BY

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IN ONE VOLUME.

ILLUSTRATED BY TWO HUNDRED AND NINETY PLATES.

KIRKSVILLE.
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TO
My Present and Former Students of Anatomy
THIS WORK
IS AFFECTIONATELY DEDICATED
BY
THEIR FELLOW WORKER,
THE AUTHOR.

Qui non proficit, deficit.

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Preface.

Preface to Second Edition.

Six years ago the author compiled a little book of one hundred and fifty pages called *Anatomy in a Nut Shell*, which was the outgrowth of his studying and teaching anatomy in the American School of Osteopathy. It filled its place as it was intended only as an aid to the student in preparing his work. There seemed to be no work upon anatomy taken up in a teachable and systematic manner and the student complained that it took more time to find his lesson in the books at hand than to learn it when found.

In presenting the subject of anatomy to the student, we first teach a few rules and fundamental principles to give him a working knowledge of the subject, and then we take up the work complete as it comes in the human body. For instance in teaching the anatomy of the arm we take the clavicle, giving its ossification, articulations, attachment of muscles and blood supply. Then the origin and insertion with action, blood supply and nerve supply of these muscles. So it is with every bone of the upper extremity and the entire body.

What is gained by saying that the greater tuberosity of the humerus has three muscles attached to it, namely the *Supraspinatus*, *Infraspinatus* and *Teres minor*, unless we learn the functions of these muscles? By this method of teaching anatomy we find it to be one of the most interesting of all subjects both to teacher and pupil.

The original book of one hundred and fifty pages has been revised and enlarged to over six hundred pages, but the name *Anatomy in a Nut Shell* is retained, because any book of six hundred pages covering such an inexhaustible subject as human anatomy would be a *Nut Shell* indeed.

In preparing this work the following authors, through their writings, have been my constant companions: Gray, Gerrish, Morris, Deaver, Potter, Holden, Heath, Cunningham, McClellan, Eckley, Rockwell, Butler, Hale, and last but not least, Dr. A. T. Still has been my inspiration and best teacher.

The entire work is given in lessons so that each day the student has some thing definite to do.

"He who every morning plans the transactions of the day, and follows out that plan, carries on a thread which will guide him through the labyrinth of the most busy life."—Blair.

"The chief art of learning is to attempt but little at a time."—Locke.

What was omitted in the first edition, such as the origin and insertion of muscles, is here given, so that the work is complete in itself. And any one who masters this work can justly feel proud of his anatomical knowledge.

The author was most fortunate in securing Dr. Wm. Most, a senior student of the American School of Osteopathy, to make the drawings, and he is especially grateful to his wife, Dr. Isabel Cash Laughlin for writing the entire manuscript the last time over and assisting in proof-reading. Dr. A. E. Daugherty, editor of the A. S. O. Student, deserves special mention for making the index.

* * *

Preface to First Edition.

This book is not intended to take the place of any standard text-book in anatomy, but is to be used as an aid for the student. The origin and insertion of the muscles have not been given, as that is out of the province of this book. In preparing this book, several authorities have been consulted, as A. T. Still, Gray's Anatomy, Morris' Anatomy, Gerrish's Anatomy, Century Dictionary, etc.

ANATOMY IN A NUTSHELL.

LESSON 1.

Anatomy is concerned with the form, structure and connections of the parts of the body. It has the following divisions:

1. Osteology (os-te-ol-o-je) is the anatomy of the bones.
2. Syndesmology (sin-dez-mol-o-je) is the anatomy of the joints.
3. Myology (mi-ol-o-je) is the anatomy of the muscles.
4. Angiology (an-je-ol-o-je) is the anatomy of the vessels.
5. Neurology (nu-rol-o-je) is the anatomy of the nerves.
6. Splanchnology (splangk-nol-o-je) is the anatomy of the viscera.
7. Adenology (ad-en-ol-o-je) is the anatomy of the glands.
8. Dermatology (der-mat-ol-o-je) is the anatomy of the skin.
9. Genesiology (jen-e-zc-ol-o-je) is the anatomy of the generative organs.

Aponeurosis (ap-on-u-ro-sis) is the end of a muscle where it becomes a tendon.

(a) It is any fascia or fascial structure, especially the tendons of a muscle when broad, thin, flat and of a glistening white color.

(b) It is the expansion of a tendon covering more or less of a muscle.

(c) It is a thin, whitish ligament.

The name was given to these structures when they were supposed to be expansions of nerves—any hard, whitish tissue being then considered nervous. In present usage aponeurosis is nearly synonymous with fascia, but it is oftener applied to the fascia like tendons of muscles; as the aponeurosis of the external oblique of the abdomen. (Plate XV.)

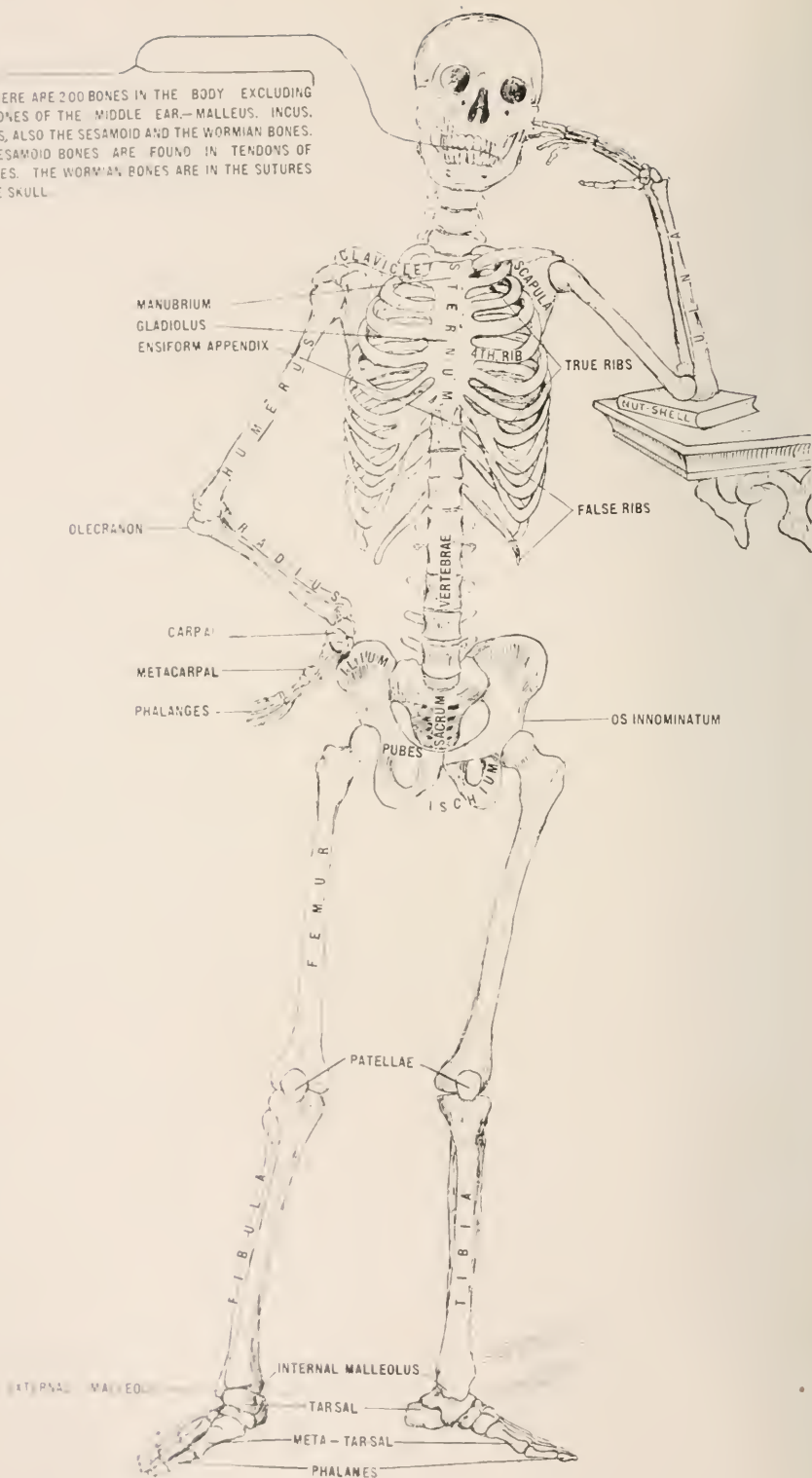
Fascia is a sheet or layer of dense connective tissue. The general contour of the body is invested, just beneath the skin, with a thin, light fascia, as distinguished from the thicker, tougher and more densely fibrous deep fascia which invests and forms sheaths for muscles and dips down among the muscles and bundles of muscular fibers forming intermuscular septa.

A tendon is a band or layer of dense fibrous tissue at the end of a muscle for attachment to a hard part. A very hard flat tendon is called fascia and aponeurosis. Tendons are directly continuous at one end with the periosteum and at the other end with the fascial tissue which invests the muscle.

A **sinus** means a cavity in bone or other tissue. The sinus of the superior maxillary bone is called the antrum of Highmore. The veins of the dura mater are called sinuses.

PLATE I.

THERE ARE 200 BONES IN THE BODY EXCLUDING THE BONES OF THE MIDDLE EAR.—MALLEUS, INCUS, STAPES, ALSO THE SESAMOID AND THE WORMIAN BONES. THE SESAMOID BONES ARE FOUND IN TENDONS OF MUSCLES. THE WORMIAN BONES ARE IN THE SUTURES OF THE SKULL.



THE BONY MAN.

All **processes** of bone are either apophyses or epiphyses. An apophysis is a process that has grown from the bone and has no separate ossific center. An epiphysis has a separate ossific center and is joined to another bone by cartilage. This cartilage becomes ossified but this change does not make the epiphysis an apophysis. Once an epiphysis always an epiphysis. The head of the femur is an epiphysis and the neck of the femur is an apophysis.

The **nutrient** arteries of the bones of the arm and forearm run towards the elbow; in bones of the lower extremity they run from the knee.

Rule 1.—The epiphysis towards which the nutrient artery runs joins the bone first always, but ossifies last in all bones except the fibula.

Rule 2.—When there is but one epiphysis then the nutrient artery runs towards the end of the bone which has no epiphysis; e. g., the clavicle and metacarpals and metatarsals. (Plate VII.)

Rule 3.—When there are two or more nucleii in an epiphysis they consolidate before the epiphysis joins the diaphysis.

Rule 4.—The epiphysis which ossifies first is the larger, and the cartilage between it and the diaphysis grows longer and faster than the cartilage at the other extremity of the bone.

An **epiphysis** may become separated from the diaphysis and such an injury may be mistaken for a fracture or dislocation. A knowledge of this principle is of great importance in medical jurisprudence; e. g., the epiphysis at the distal end of the femur ossifies at the ninth month of fetal life.

The covering of bone is called periosteum. It covers all the bone except the articular cartilage and gives attachment to tendons. Periosteum besides giving attachment to the tendons of muscles;

1. Gives nutrition to the bone.
2. Forms all capsular ligaments.
3. Tends to hold the end of broken bones.
4. From it the bone grows in thickness.
5. It hinders the progress of contiguous inflammation.

A long bone grows in length by the development of the epiphyseal cartilage and interstitial deposits; in thickness from the osteogenetic layer of the periosteum and interstitial deposits.

There are 200 bones in the body (Plate I.) They are divided into long, short, flat and irregular ones. 90 of the bones are **long ones** and are found in the extremities. In reality a long bone may not be as long as a flat or irregular one or even a short bone, e. g., the last phalanx is shorter than the os calcis. The long bones act as levers and have a medullary canal in the center of each; and a shaft called diaphysis, and two extremities. They are developed by osseous deposits in cartilage. In each upper extremity there is a clavicle, humerus, ulna, radius, five metacarpal and fourteen phalanges, making 23 long bones in each upper extremity, then in both extremities there are 2×23 or 46 long bones. In each lower extremity there is a femur, tibia, fibula, five metatarsals and fourteen phalanges, making 22 long bones in each lower extremity, then in both extremities there are 2×22 , or 44 long bones. The 46 long bones in the upper extremity and the 44 long ones in the lower extremities make

90 long bones. There are 30 **short bones**. They also are developed by osseous deposit in cartilage and are found in the extremities. They are found where strength but not much motion is required. In each carpus (Plate XXVI.) there are 8 bones, viz., scaphoid, semi-lunar, cuneiform, pisiform, trapezium, trapezoid, os magnum and unciform, making 8 bones; 2×8 are 16, the number of short bones in the two upper extremities. In each ankle, (Plate LIV.) there are 7 bones, viz., os calcis, astragalus, navicular or scaphoid, cuboid, external cuneiform, middle cuneiform, and internal cuneiform, making 7 short bones in each tarsus; then in the two tarsi there are 2×7 or 14 short bones; the 14 short bones in the lower extremity and the 16 short ones in the upper extremity make the 30 short bones.

LESSON II.

There are 40 flat bones, all of which are found in the trunk, and head except four and these are in the extremities. They are the two patellæ and two scapulae. The flat bones in the trunk protect the viscera. They are developed by osseous deposits in membranes and consist of two dense layers separated by cellular or cancellated osseous tissue, the diploe. There are the two parietal, frontal and occipital in the cranium. In the face there are two nasal, two lachrymal and the vomer. In the thorax 24 ribs and the sternum; then there are the two innominata, two patellæ, two scapulae, making 40 flat bones in the body.

There are 40 irregular bones. They are found in the trunk and head. They are the 24 vertebrae, the sacrum, coccyx, two temporal, ethmoid, sphenoid and the bones of the face except the two nasal, two lachrymal and the vomer. Then the hyoid bone.

There are 8 bones in the cranium. The 4 flat ones are the frontal, two parietal and occipital; the 4 irregular ones are two temporal, sphenoid and ethmoid.

There are 14 bones in the face; the 5 flat ones are the two nasal, two lachrymal and vomer. The 9 irregular ones are the two superior maxillary, two malar, two palate, two inferior turbinated and the inferior maxillary.

Then in the cranium and the face together there are 8 plus 14, making 22 bones. In the trunk there are 75 bones, if the 22 of the head are included. In the trunk without the head there are 53 bones, which are 24 vertebrae, 24 ribs, sternum, sacrum, coccyx and two innominata. In the extremities there are 124 bones, 64 in the upper and 60 in the lower. In the pelvis there are 4 bones, two innominata, sacrum and coccyx. Not counting the vertebrae in the cranium there are 33 vertebrae; 7 cervical, 12 dorsal, 5 lumbar, 5 sacral and 4 in the coccyx. There are 12 pairs of ribs, 7 of which are true and 5 false, 2 of which are floating.

Besides the 200 bones mentioned there are sesamoid bones which are developed in tendons such as the patellæ, but these on account of their size and shape are called flat ones; and the wormian bones, which are found in the sutures of the skull; and the malleus, incus and stapes found in the middle ear.



THE MUSCULAR MAN.

There are 32 teeth; in each jaw there is one pair of canine, two pairs of incisors two pairs of bicuspid, and three pairs of molars.

The eminences of bones are:

1. Apophyses—an example, neck of the femur.
2. Condyles, which mean irregular heads—example, lower part of the femur.
3. Epiphyses—example, head of femur.
4. Heads, smooth and convex, found in joints—on femur and humerus.
5. Spines, sharp and slender—on vertebrae.
6. Trochanters, for turning joints—on the femur.
7. Tubercles, small tuberosities—deltoid tubercle on clavicle.
8. Tuberosities, broad prominences—on the humerus.

Besides these 8, there are 14 other prominences on bones.

1. Azygos, without a fellow—odontoid on axis.
2. Clinoid, like a bed—on the sphenoid bone.
3. Coracoid, like a crow's beak—on the scapula.
4. Coronoid, like a crown—on the ulna.
5. Hamular, hook-like—on sphenoid.
6. Malleolar, mallet-like—lower part of fibula.
7. Mastoid, nipple-like—on temporal bone.
8. Odontoid, tooth-like—on axis.
9. Pterygoid, wing-like—on sphenoid.
10. Rostrum, a beak—on sphenoid.
11. Spinous, thorn-like—on sphenoid.
12. Squamous, scaly—on temporal.
13. Styloid, pen-like—on temporal.
14. Vaginal, ensheathing—on temporal.

There are 5 articular cavities in bones.

1. Alveolar, socket-like—tooth in the jaw.
2. Cotyloid, cup-like—hip-joint.
3. Facet, face—on the great tuberosity.
4. Glenoid, shallow—shoulder-joint.
5. Trochlear, pulley-like—in the orbit.

There are 10 non-articular cavities.

1. Aqueducts—Aqueduct of Fallopii in temporal bone.
2. Canals—Vidian canal in sphenoid bone.
3. Cells—Mastoid cells in mastoid process of temporal bone.
4. Depressions—Meckel's cave on petrous portion of temporal bone.
5. Fissures—Sphenoidal fissure in sphenoid bone.
6. Foramina—Base of skull.
7. Fossae; also at base of skull.
8. Grooves—On inner surface of Parietal bone for middle meningeal artery.
9. Notches—Ethmoid notch on frontal bone.
10. Sinuses—Frontal sinus, superior maxillary sinus which is called Antrum of Highmore.

- | | |
|---------------------------------|----------------------------------|
| 1. Radius means spoke | 27. Cuboid—cube |
| 2. Carpus—wrist | 28. Cranium—helmet |
| 3. Scaphoid—boat | 29. Frontal—forehead |
| 4. Semilunar—half moon | 30. Occipital—against the head |
| 5. Cuneiform—wedge-like | 31. Parietal—wall |
| 6. Pisiform—pea-like | 32. Ethmoid—sieve |
| 7. Trapezium—table | 33. Sphenoid—wedge |
| 8. Trapezoid—table shape | 34. Temporal—time |
| 9. Os Magnum—large bone | 35. Nasal—nose |
| 10. Unciform—hook | 36. Superior Maxillary—jaw bone |
| 11. Metacarpus—beyond the wrist | 37. Inferior Maxillary—mandible. |
| 12. Phalanges—fingers and toes | 38. Lachrymal—tear |
| 13. Pelvis—basin | 39. Malar—cheek |
| 14. Femur—thigh | 40. Palate—palate |
| 15. Patella—small pan | 41. Turbinated—whirl |
| 16. Tibia—flute | 42. Vomer—ploughshare |
| 17. Fibula—clasp. | 43. Vertebra—to turn |
| 18. Obturator—closed. | 44. Thorax—chest |
| 19. Glenoid—shallow | 45. Sacrum—sacred |
| 20. Cotyloid—cup-like | 46. Coccyx—cuckoo |
| 21. Tarus—ankle | 47. Innominata—without a name |
| 22. Os calcis—heel | 48. Clavicle—key |
| 23. Astragalus—die | 49. Scapula—spade |
| 24. Navicular or scaphoid—boat | 50. Humerus—arm |
| 26. Cuneiform—wedge-like | 51. Ulna—elbow |
| 25. Thyroid—shield. | 52. Sternum—breast plate |

LESSON III.

MUSCLES.—We have said there are 200 bones in the body, but the number of muscles cannot be given exactly, for there are some which at times are absent and again double. There are, ordinarily, thirteen muscles from the knee to the ankle, but there may be only twelve or there may be fourteen, as the *Plantaris* may be absent or double.

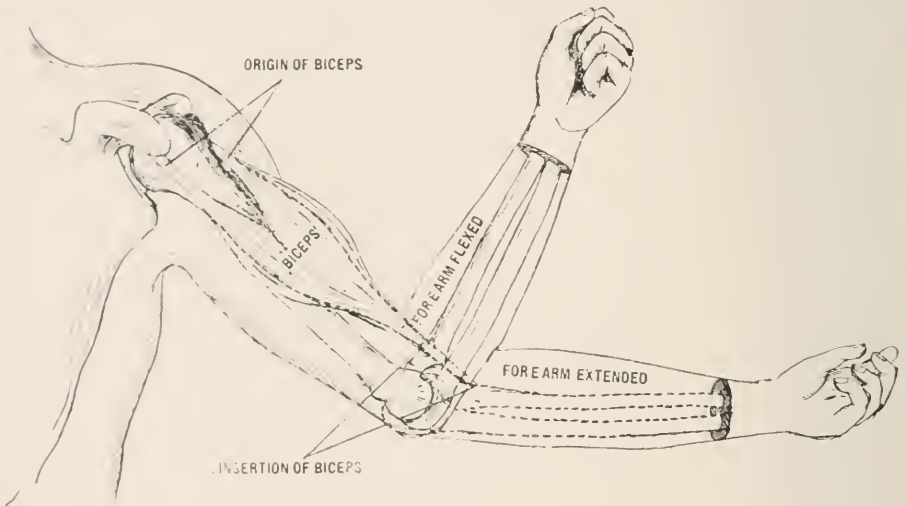
The *Infracostals* vary in number, however, there are generally ten pairs. Ordinarily there are twenty muscles in the forearm, sometimes nineteen, other times twenty-one as the *Palmaris longus* may be absent or double. So it is impossible to give the exact number. However, there are more than 550 muscles in the human body. (Plate II.) The muscles give form to the body and move it from place to place. **They take their names in various ways.**

1. From the attachment, as *Sterno-cleido mastoid*, which means this muscle is attached to the sternum, and the clavicle (key) and the mastoid process of the temporal bone.

2. From the number of parts, as Biceps, which means two heads, and Triceps, which means three heads.
3. From the shape, as Deltoid, like the Greek letter delta, inverted.
4. From the function, as Levator anguli scapulæ, which means to lift the angle of the scapula.
5. From the position, as Subclavius and Subscapularis which means under the clavicle and under the scapula.
6. From the function, attachment and shape, as Pronator radii teres, which means this muscle first pronates, second it is attached to the radius, and third it is round (teres).

Muscles have two or more points of attachments; the part which is most stationary is called the "origin" and is generally the larger; the most movable

PLATE III.



SHOWING THE ORIGIN AND INSERTION OF THE BICEPS.

part is called the "insertion" and is generally the smaller part of the attachment of the muscle. (Plate III.) Muscles must have a blood and nerve supply in order to be in a healthy condition. **PRINCIPLE:** Function makes structure and the cessation of function leads to the disappearance of structure. For instance, in the primitive man the Pectorialis minor muscle was continued from the coracoid process of the scapula to the humerus; now this part of the muscle is a ligament. Again, the internal lateral ligament of the knee was at one time a part of the Adductor magnus muscle. The long external lateral ligament of the knee was at one time a part of the Peroneus longus, and the ligamentum teres belonged to the Pectineus muscle.

JOINTS AND LIGAMENTS.—A joint is made up of two or more bones, a synovial membrane, articular cartilage, white fibrous cartilage, and ligaments, and is for the purpose of motion. The bones are larger where they enter into

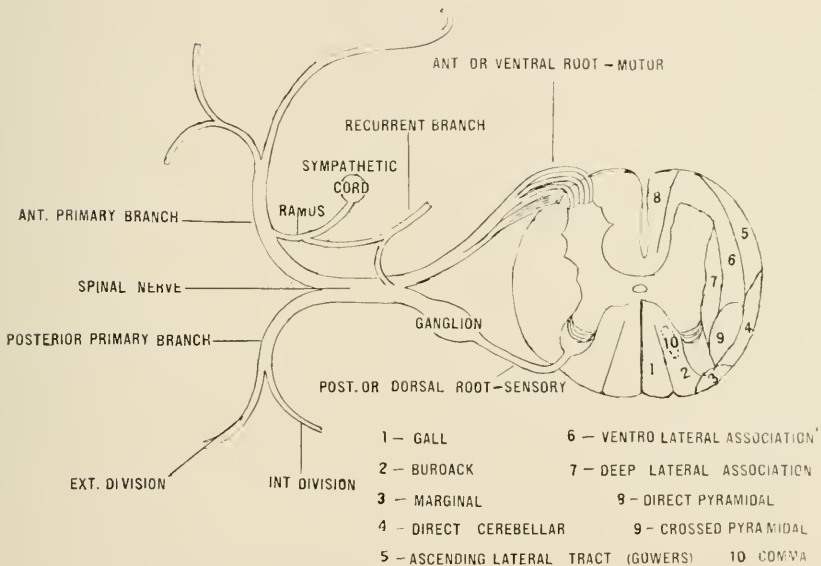
the joint and are covered with articular cartilage. This cartilage has no blood vessels, is a hyaline variety, and is nourished by the lymph. These bones are held together by ligaments (to bind) which are flexible but not extensible. Joints, like muscles must have blood and nerve supply.

Hilton's Law—A nerve trunk which supplies a joint supplies the muscle which moves the joint and the integument over the fullest insertion of the muscle. The Circumflex nerve to the shoulder joint is a good example of this law.

There are three great classes of joints in the body:

- A. **Immovable or Synarthrosis.**
- B. **Partly movable or Amphiarthrosis.**
- C. **Freely movable or Diarthrosis.**

PLATE IV.



A TRANSVERSE SECTION OF THE SPINAL CORD.

Under (A) **Synarthrosis** we have the following:

1. True sutures or sutura vera.
 - a. Dentata as interparietal.
 - b. Serrata as interfrontal.
 - c. Limbosa as fronto-parietal.
2. Sutura notha.
 - a. Squamosa as squamo-parietal.
 - b. Harmonia as intermaxillary.
3. Schindylesis as the sphenoid with the vomer.
4. Gomphosis, as the teeth.
5. Synchondrosis, which means the union of bones by means of fibrous or elastic cartilage, e. g., epiphyseal lines.

B. Amphiarthrosis.

1. Symphysis, as between bodies of vertebræ; and the anterior part of the innominata; symphysis pubes. This kind of joint has no synovial membrane.

2. Syndesmosis, as the inferior tibio-fibular articulation.

C. Diarthrosis.—All the diarthrosis or movable joints are represented in the shoulder girdle and the upper extremity.

1. Arthrodia (gliding) in the acromio-clavicular-joint.

2. Enarthrodia, (ball-and-socket) in the shoulder-joint.

3. Ginglymus (hinge) in the elbow.

4. Trochoides or Pivot-joint, in the superior radio-ulnar joint.

5. Condylloid, as the wrist-joint, having all movements except axial rotation.

6. Reciprocal Reception (saddle shaped-joint) in the carpo-metacarpal joint of the thumb.

Ligaments take their names from the bones they join, as sterno-clavicular ligament which joins the sternum and the clavicle. When it goes across a notch or groove it is called a transverse ligament and when it goes around a joint it is called a capsular ligament. Ligaments are composed mostly of white fibrous tissue; the ligamenta subflava, and the ligamentum nuchæ of the lower animals are yellow elastic tissue.

Nerves.—If a nerve goes to integument it is called "cutaneous;" if it goes to muscles, it is called "muscular;" if it goes to muscles and integument, it is called "musculo-cutaneous." There are twelve pairs of cranial nerves and thirty-one pairs of spinal nerves. All spinal nerves are compound nerves because they have an anterior root which is motor and a posterior root which is sensory. These two roots unite to form the nerve which contains both motor and sensory fibers. Each nerve as it leaves the spinal foramen divides into an anterior and posterior branch.

Principle I.—(Plate IV.) Posterior nerve roots are larger than anterior nerve roots, with the single exception of the first cervical. They are from one and one-half to three times as large.

Principle II.—The anterior branches are larger than the posterior branches in all cases except the first and second cervical nerves.

Principle III.—The posterior branches divide into an internal and external division in all cases except the first cervical, fourth and fifth sacral, and coccygeal nerves.

Principle IV.—The anterior branches make the plexuses.

Principle V.—(Plate V) The posterior nerve root has a ganglion upon it which lies in the intervertebral foramen, outside the sac of the dura mater, except the first one which is not always present, and when present is situated within the dura mater. This one, and the second, are placed on the arches of the vertebræ over which the nerves pass. The ganglia of the last four sacral nerves are situated outside the dura mater but in the spinal canal; the coccygeal ganglion when present is within the dura mater. The nervi nervorum are nerve filaments going to the nerves and the nerve sheaths.

LESSON IV.

The roots of the first and second spinal nerves pass outward at right angles. All the rest pass obliquely downward and outward, and as the cord ends at the second lumbar, the lower roots have a long course before they leave the canal, and are situated around the filum terminale of the spinal cord forming the cauda equina.

A **motor** nerve is any nerve whose function is to excite muscular contraction, and thus effect movement in an animal body. Most nerves are mixed in character or sensorimotor, effecting both motion and sensation.

A **sensory** nerve is a nerve conveying sensory impulses, or more strictly, one composed exclusively of sensory fibers; nearly equivalent to afferent nerve.

Vasomotor nerves are those which supply the muscular coats of the blood-vessels.

A **nerve center** is a group of ganglion-cells closely connected with one another and acting together in the performance of some function, as the cerebral centers.

Of the **cranial nerves**, some are compound, some are motor and others are nerves of special sense. They take their names, olfactory, optic, etc., from their function, but the names, first, second, etc., from the order of piercing the dura mater from before backward.

TABLE OF CRANIAL NERVES.

NAME.	DISTRIBUTION.	FUNCTION.	METHOD OF EXIT.
1st. Olfactory.	Upper third of nasal cavity.	Special sense Smell.	Cribiform Plate of Ethmoid.
2nd. Optic.	Retina.	Special sense Sight.	Optic Foramen.
3rd, Oculomotor.	Muscles of eyeball except External rectus and Superior oblique.	Motor.	Sphenoidal Fissure.
4th. Trochlear.	Superior oblique of eyeball.	Motor.	Sphenoidal Fissure.
5th. Trifacial.	Sensory part to face, fore part of scalp, external ear, eye, teeth, gum, cheek, fore part of tongue. Motor part to muscles of mastication.	Ordinary Sense and motor.	Ophthalmic division thro Sphenoidal Fissure. Superior Maxillary thro Rotundum, Interior Maxillary thro Ovale.
6th. Abducent.	External rectus muscle of eyeball.	Motor.	Sphenoidal Fissure.

TABLE OF CRANIAL NERVES—CONTINUED.

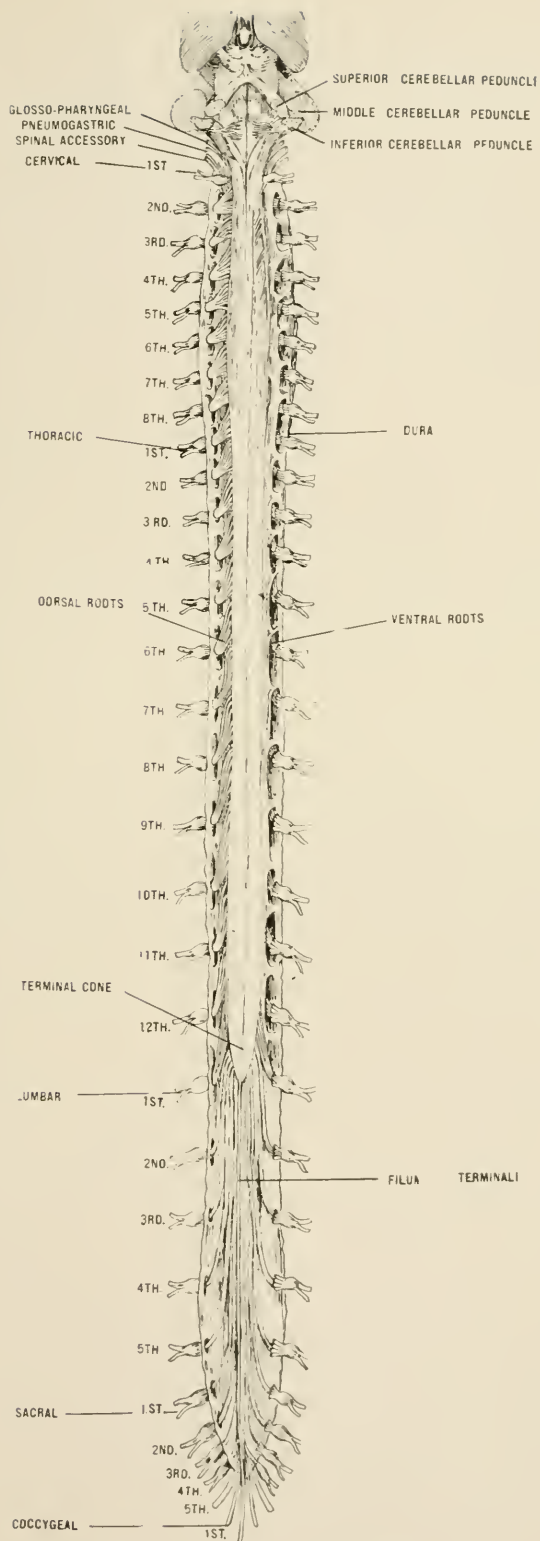
NAME.	DISTRIBUTION.	FUNCTION.	METHOD OF EXIT.
7th. Facial.	Superficial muscles of face, Frontalis, Platysma, Stylo-hoid and posterior belly of Digastric.	Motor.	Internal Auditory Meatus and leaves by Stylo-mastoid Foramen.
8th. Auditory.	Membranous labyrinth of ear.	Special sense, (hearing) and Equilibrium.	Internal Auditory Meatus; remains in ear.
9th. Glosso-Pharyngeal.	Pharynx and hind part of tongue; some motor fibers.	Special sense (taste). Ord'y Sense, Motor.	Jugular Foramen.
10th. Pneumo-gastric or Vagus.	Sensory to external ear, motor and sensory to pharynx, larynx, trachea, lungs, oesophagus, stomach, heart, and sometimes to liver.	Ordinary sense and motor.	Jugular Foramen.
11th. Spinal Accessory.	Motor to Trapezius and Sternomastoid muscles. Rest is accessory to the pneumogastric.	Motor.	Jugular Foramen.
12th. Hypo-glossal.	Muscles of tongue.	Motor.	Anterior Condylloid Foramen.

LESSON V.

ARTERIES.

The arterial system consists of two separate divisions of circulations. The pulmonary artery with its branches forms the lesser or pulmonary circulation, and the aorta with its branches forms the greater or systemic circulation.

Blood vessels.—Vasa vasorum are blood vessels which supply the larger arteries. The blood circulates through the body to nourish the various parts. The circulation of the blood was demonstrated by Harvey in 1628. All vessels which carry blood from the heart are arteries, and those which carry blood to the heart are veins. The connecting link between the arteries and the veins is the capillaries. Harvey was not able to see these connecting links for they are microscopic and the microscope was not invented until some years later. Harvey said the blood filtered through the tissues from the arteries to the veins, which is not very far wrong. Malpighi discovered the capillaries in 1661. As a rule the arteries carry pure or oxygenized blood, and the veins carry impure or non-oxygenized blood, but there are exceptions to this rule for the pulmonary artery carries impure blood and the pulmonary veins carry pure blood. Perhaps the purest blood in the body is in the right renal vein. When the blood enters the kidney it is as pure as when it left the left ventricle of the heart and in the kidney it throws off more impurities than it takes from the kidney. The left renal vein receives the spermatic vein in the male and the ovarian vein in the female, so it contains blood less pure than the



POSTERIOR VIEW OF THE SPINAL CORD.

right renal vein. These veins of the right side enter into the inferior vena cava and have valves.

The heart is a voluntary muscle (straited) in structure but is presided over by the sympathetic nerve which makes it involuntary in action. The average weight of the heart is about 11 ounces. Its covering is called pericardium, its lining endocardium, and the muscle itself is called myocardium. It has four chambers, the two upper ones are the auricles (ears) and the two lower ones ventricles (bellies). The two auricles contract at the same time that the ventricles expand, and vice versa. The contraction is called the **systole** and the expansion the **diastole**. The systole is the work, and the diastole is the rest.

Capillaries are not found in cartilage—epithelium—epidermis. The net work of capillaries is very close in the lungs—mucous membrane—muscle and adipose tissue and in the gray matter of the brain and cord. The capillary meshes are wider and the vessels fewer in the fasciæ—aponeuroses—tendons and ligaments. In their simplest form the capillaries consist only of endothelial lining of the arteries and veins with which they are connected, being both elastic and contractile, their lumen varies under pressure. They are microscopic and in order to get a drop of blood many must be ruptured. Arteries and veins have nerves called vaso-motor which forms a net-work around the muscular coat, especially of the arteries.

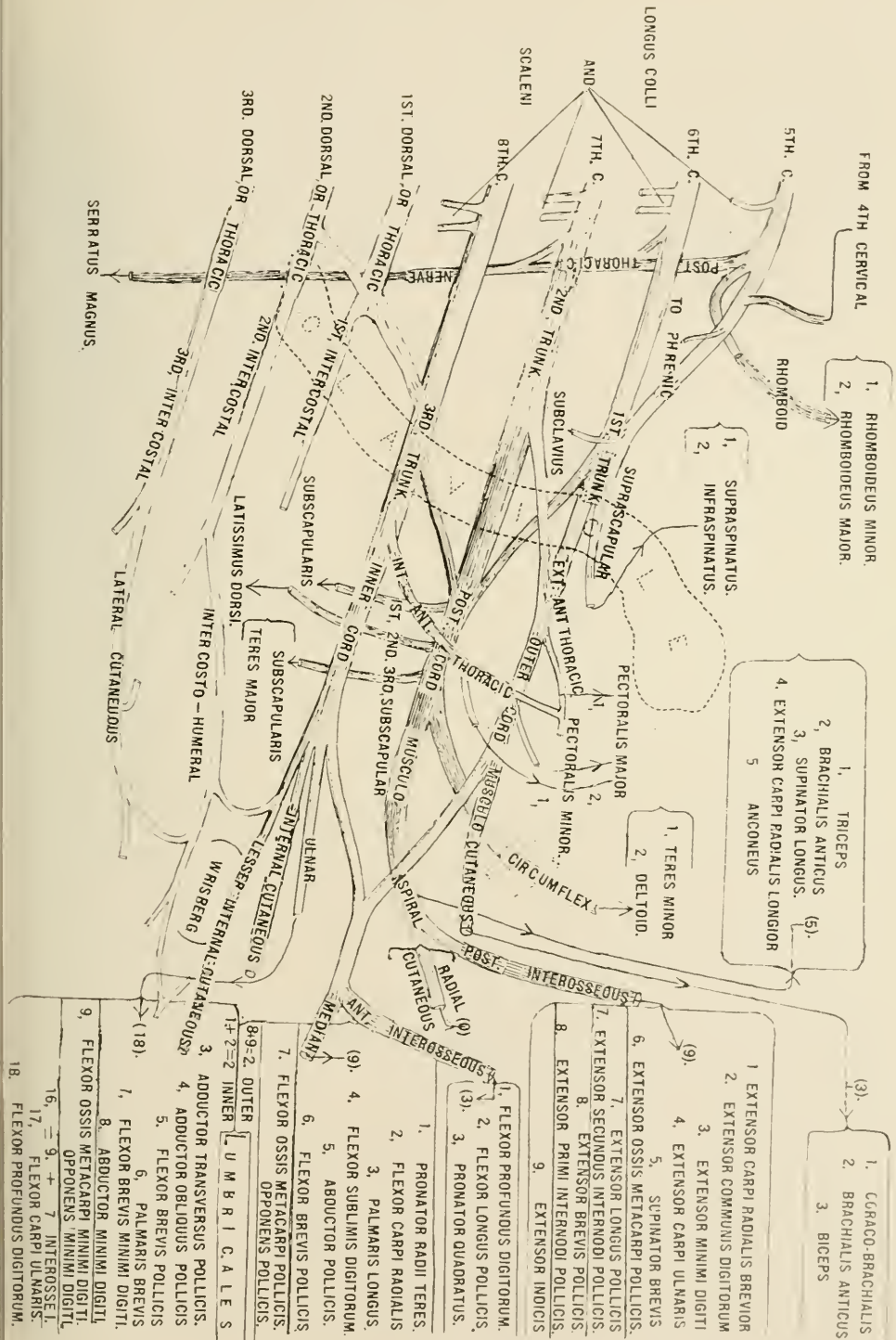
VEINS.

Veins are found in almost all the tissues and carry the blood from the capillaries to the heart. As they are generally larger and more numerous than the arteries, their total capacity greatly exceeds that of the arterial system. Not only the smaller branches, but even the larger trunks communicate with each other very freely. The venous system has two distinct subdivisions, the pulmonary and the systemic.

The **pulmonary veins** aid in the pulmonary circulation and convey arterial blood to the left auricle; they are but slightly larger than their arteries, and have no valves.

The **systemic veins** aid in the general circulation and convey venous blood to the right auricle. They are divided (systemically) into three sets; superficial, deep, and sinuses. The superficial or cutaneous veins lie just under the skin between the layers of the superficial fascia; they pierce the deep fascia to empty into the deep veins. The deep veins usually accompany the arteries and are enclosed in the same sheath. There is generally only one vein with each of the larger arteries—as the subclavian—but two (*venæ comites*) accompany each of the smaller arteries—as the radial, and all the arteries of the lower extremities except the femoral artery, one lying on each side of them; in certain regions they do not accompany the arteries. The sinuses are venous channels which are found only in the skull and are formed by a separation of the layers of the dura mater; they are lined by endothelium.

The **arteries and veins** have three coats; first the tunica intima, second the tunica media and third the tunica externa (adventitia). This third coat is the only one not ruptured in ligation of an artery. The tunica media has muscular



THE BRACHIAL PLEXUS.

fibers in it and supplied with vaso-motor nerves (vaso-constrictor and vaso-dilator). These nerves run in the same sheath and are part of the sympathetic nervous system. The vaso-constrictor acts to a greater or lesser degree at all times; the vaso-dilator acts upon the constrictor and inhibits its action.

The **artery** which passes over a joint gives off branches above and below the joint and these branches run towards the joint and join one another. This joining is called *anastomosis*. Its purpose is for the blood to run in these small arteries as a means of passing the joint when the main one is closed. This circulation is called *collateral*. Arteries and veins bear a certain relation to one another.

Rule.—(Plate VIII.) Above the diaphragm veins are on the same level, or in front of their companion arteries. Below the diaphragm the arteries are on the same level, or in front of their companion veins, excepting the renal and the profunda.

The **fetus** gets its food and oxygen from the placenta, while after birth the food comes through the alimentary canal and the oxygen through the lungs. In tracing the circulation after birth we start with the blood in the right auricle; a systole of the heart sends it through the tricuspid valve into the right ventricle; here a systole sends it through the semilunar valves into the pulmonary artery and the lungs, where it gives off carbon dioxid and receives oxygen; it is continued from the lungs through the pulmonary veins (three to five) to the left auricle of the heart, then a systole sends it through the bicuspid valve into the left ventricle; from here a systole sends it through the aorta to all parts of the body, to pass through the capillaries and to be collected into the superior and inferior venæ cavæ which empty into the right auricle of the heart.

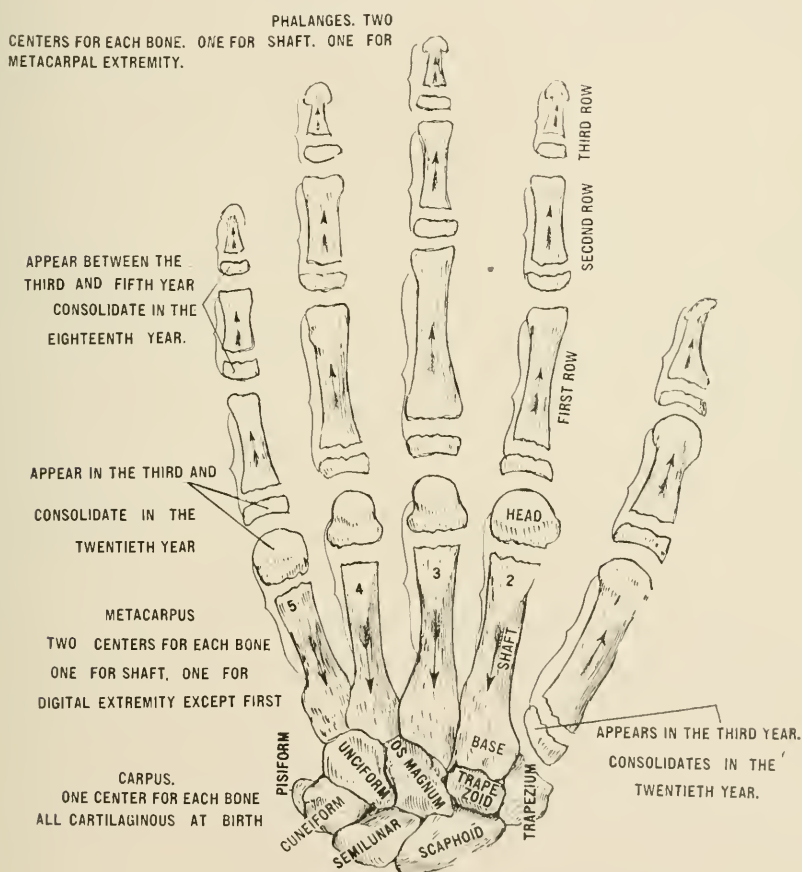
Veins have valves which keep the blood from running back in its course. All veins do not have valves; some of those which do not have valves are the veins of the dura mater, or sinuses, the pulmonary veins, veins of the portal system and those of the spinal cord. The others will be mentioned when described.

Arteries as a rule do not have valves, but there is an exception to this also; the pulmonary artery has valves. Veins receive tributaries, or radicles; arteries break into branches. The portal vein breaks into branches like an artery and the vertebral arteries join like a vein to make the basilar artery. The veins are in two sets; the superficial and the deep; the superficial ones are in the superficial fascia, but send communicating branches to the deep veins. The deep veins accompany the arteries in the extremities and there are two for each artery; they are called *venæ comites*. They are present in the arm and forearm and from the knee to the ankle, but not from the hip to the knee. The veins are larger than the arteries. If they were all put into one vessel it would be the shape of a cone with the apex at the heart and its base at the surface of the body because the combined area of the tributaries is greater than that of the main veins.

LESSON VI.

In the fetal heart the Eusatchian valve is large. The foramen ovale which joins the two auricles gives a free communication between them until the middle of fetal life, at which time a valve grows from the posterior wall of the right auricle to the left of the foramen ovale, and prevents the blood from passing through except from right to left. In twenty per cent of the cases the foramen ovale remains open throughout life. (Plate IX.)

PLATE VII.



NUTRIENT ARTERIES OF BONES OF HAND.

The ductus arteriosus which is about half an inch long joins the descending aorta just below the origin of the left subclavian artery.

It arises from the left pulmonary artery—at first from the common pulmonary.

The hypogastric or umbilical arteries arise from the internal iliac, and after passing beside the bladder go through the umbilicus to the placenta.

The **umbilical vein** passes from the placenta to the under surface of the liver going through the umbilicus and the free margin of the suspensory ligament. At the transverse fissure this vein divides into two branches. A large one which is joined by the portal vein and enters the right lobe of the liver. A smaller one—the ductus venosus—joins the left hepatic vein at its junction with the inferior vena cava. Before it divides the umbilical vein gives branches to the left, quadrate, and Spigelian lobes.

The **pure blood coming from the placenta** in the umbilical vein reaches the inferior vena cava in three ways:

1. A small quantity via ductus venosus into the hepatic veins and inferior vena cava.
2. Some enters the liver directly and then passes through the hepatic veins.
3. Most of it passes through the liver with the portal venous blood and then through the hepatic veins.

In the **inferior vena cava** all this blood mixes with venous blood from the lower extremities and abdominal wall. It now enters the right auricle from which it passes to the left auricle through the foramen ovale being guided by the Eustachian valve. In the left auricle it mixes with the blood which comes from the pulmonary veins, which is venous and a small amount. It now passes through the auriculo-ventricular opening into the left ventricle, from here through the aorta to the head and upper extremity, some passing into the descending aorta. The venous blood from the upper extremities and head descends in the superior vena cava into the right auricle of the heart and here it mixes with a small part of the blood from the inferior vena cava. From here it passes through the auriculo-ventricular opening to the right ventricle. A systole sends the blood from the right ventricle into the pulmonary artery, a small part of the blood passing into the lungs and the remainder goes through the ductus arteriosus to the descending aorta, where it mixes with blood from the left ventricle after it has passed through the arch of the aorta. Most of the blood in the descending aorta passes through the umbilicus to the placenta, and the rest to the lower limbs and viscera.

The **adult gets** nourishment from the alimentary canal and oxygen from the lungs. The placenta acts both as a nutritive and a respiratory organ. The liver, the head, and the upper extremities are large in the fetus because the purely arterial blood passes to these organs. The other viscera and the lower extremities are small because the blood which passes to them is practically venous.

At **birth** the placental circulation stops, while the pulmonary circulation is increased and the lungs expand. The foramen ovale closes about the tenth day and the valvular folds adheres to its margin. As said before, the foramen ovale remains open throughout life in one case out of five. The umbilical arteries become obliterated beyond the bladder in from two to five days. The umbilical vein and ductus venosus close about the same time as the umbilical arteries. The ductus arteriosus closes in from four to ten days.

A **plexus** is a net-work. (Plate VI.) The Brachial Plexus is a net work of nerves situated in the axilla. It is called brachial because its branches supply

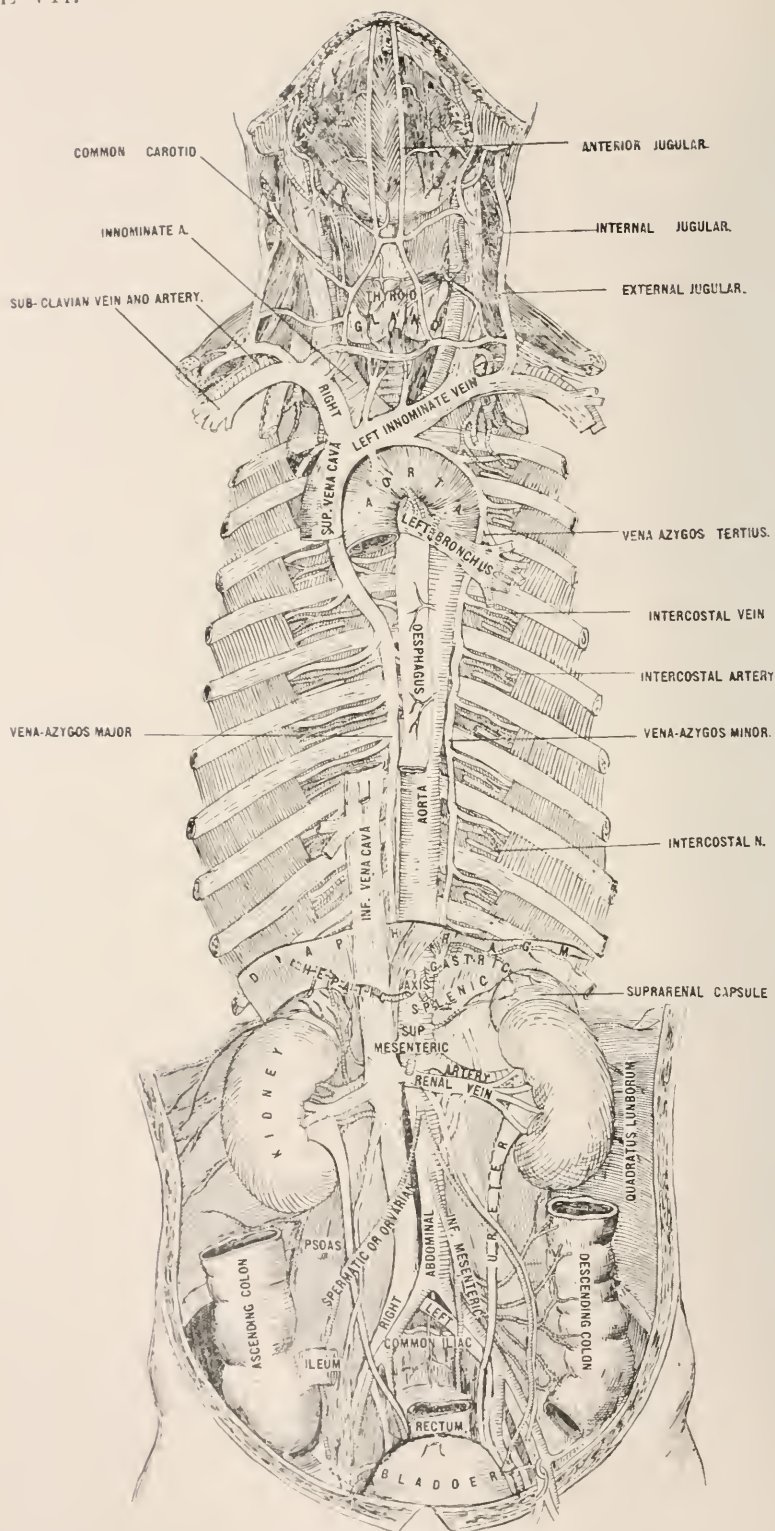
the arm or brachium. On each side of the spinal cord are five plexuses, making five pairs in all. We learn the anatomy of the lateral half of the body and the other half is similar, with a few exceptions in the viscera. The first plexus is made of the anterior divisions of the first four cervical nerves and is called the Cervical Plexus. The next plexus in order is called the Brachial, and is composed of the anterior branches of the fifth, sixth, seventh and eighth cervical nerves and part of the first dorsal nerve. In the dorsal or thoracic region there are no plexuses, except sympathetic. There are plexuses of nerves where there is much work to be done by the nerves. The next plexus is the Lumbar which is composed of the anterior branches of the first, second, third and part of the fourth lumbar nerves. The part of the fourth lumbar nerve which does not enter into the formation of this plexus joins the fifth lumbar nerve and these two nerves make the lumbo-sacral cord which, although it has lumbar nerves in it, belongs to the sacral plexus. This cord with the anterior divisions of the first, second, third and part of the fourth sacral nerves make the Sacral Plexus. The remaining part of the fourth nerve with the fifth and coccygeal nerve, make the Coccygeal Plexus. As the spinal cord is so much shorter than the spinal canal, the nerves leave the cord above the foramina where they leave the spinal canal.

There are eight cervical nerves although only seven cervical vertebræ, as the first cervical, or suboccipital nerve, is above the atlas and the eighth cervical nerve below the seventh cervical vertebra, or vertebra prominens. The eight cervical nerves leave the cord above the spinous process of the sixth cervical vertebra.

There are twelve pairs of dorsal or thoracic nerves; the first six of these leave the cord between the spinous processes of the sixth cervical and the fourth dorsal vertebra; the lower six dorsal or thoracic nerves leave the cord between the spinous processes of the fourth and eleventh dorsal. The five lumbar nerves leave the cord between the spinous processes of the eleventh and twelfth dorsal. The five sacral nerves leave the cord between the spinous processes of the twelfth dorsal and the first lumbar. The lower nerve roots have such a long course between the cord and the foramina that they are called cauda equina (horse tail.)

LESSON VII.

Clavicle (Key.)—This is a long bone but it has no medullary canal as the other long bones have. It is quite elastic, and with the scapula acts as a cushion to lessen the force of blows upon the shoulder. In some animals it does not articulate with any other bone, but is held in position by the muscles. This bone and the scapula make the shoulder girdle. It is present in those animals which have claws and use the upper or front extremity for other purposes than that of progression. It acts as a fulcrum for the various movements of the upper extremity. It is situated at the upper anterior part of the chest, between the manubrium of the sternum and the acromion process of the scapula. It has a double curve with the convexity anterior at the sternal extremity and the con-



RELATIVE POSITION OF VESSELS ABOVE AND BELOW THE DIAPHRAGM.

cavity anterior at the acromial extremity. It is more often broken than any other bone in the body and when broken will press upon the Brachial Plexus producing temporary paralysis. It has but one epiphysis, which is at the sternal extremity, hence the nutrient artery runs towards the acromial extremity (Rule 2, Lesson 1.) The bone is divided into an inner two-thirds which is somewhat triangular on cross-section, and an outer one-third which is more flattened from above downward; the coracoid process of the scapula is under this division of the clavicle. (Plates X-XI.)

Outer one-third.—The upper extremity of this portion has the attachment of the Deltoid muscle in front and the Trapezius behind, with a small interval between them. The under surface has first a conoid tubercle near the posterior border and internal boundary of this part of the bone. The conoid ligament passes from this tubercle to the coracoid process of the scapula, which is immediately under it. Second, the trapezoid, or oblique line, sometimes a furrow, passes from the conoid process forward and outward and gives attachment to the trapezoid ligament. The conoid and trapezoid ligaments make the coraco-clavicular ligament. The anterior border is concave and gives attachment to the Deltoid; this border has a deltoid tubercle. The posterior border is broader than the anterior one; it is convex and gives attachment to the Trapezius.

Inner two-thirds.—This part may be described as having three borders and three surfaces. The anterior border extends from the anterior border of the outer one-third to the inner extremity of the bone, separating the anterior and inferior surfaces. The superior border extends from the upper part of the posterior border of the outer one-third to the inner extremity of the bone, separating the anterior and posterior surfaces of the clavicle. The posterior border extends from the conoid tubercle to the rhomboid impression, separating the posterior and inferior surfaces. The anterior surface gives attachment to the Pectoralis major and the Sterno-cleido-mastoid muscles. The posterior surface gives attachment to the Sterno-hyoid and occasionally the Sterno-thyroid. It has a nutrient foramen which is directed outward according to Rule 2, Lesson 1. Sometimes there are two foramina, one of which may be on the inferior surface. The inferior or subclavian surface has near its inner part the rhomboid impression which gives attachment to the costo-clavicular or rhomboid ligament; this impression is about as inch long. The subclavian groove occupies about the middle one-third of the under surface of the clavicle and gives attachment to the Subclavius muscle. The **sternal extremity** is triangular, with one angle above and two below; it looks inward, downward and a little forward. It is convex from above down and concave antero-posteriorly. It articulates with the manubrium and its circumference is rough for the attachment of the ligaments of this joint. The **acromial extremity** has an oval articular facet somewhat convex, which is directed downward and forward to articulate with the acromion; its circumference is rough for the attachment of the ligaments of this joint. The right clavicle is longer, thicker, and rougher than the left. Those of the male are longer, thicker, rougher and more curved than those of the female.

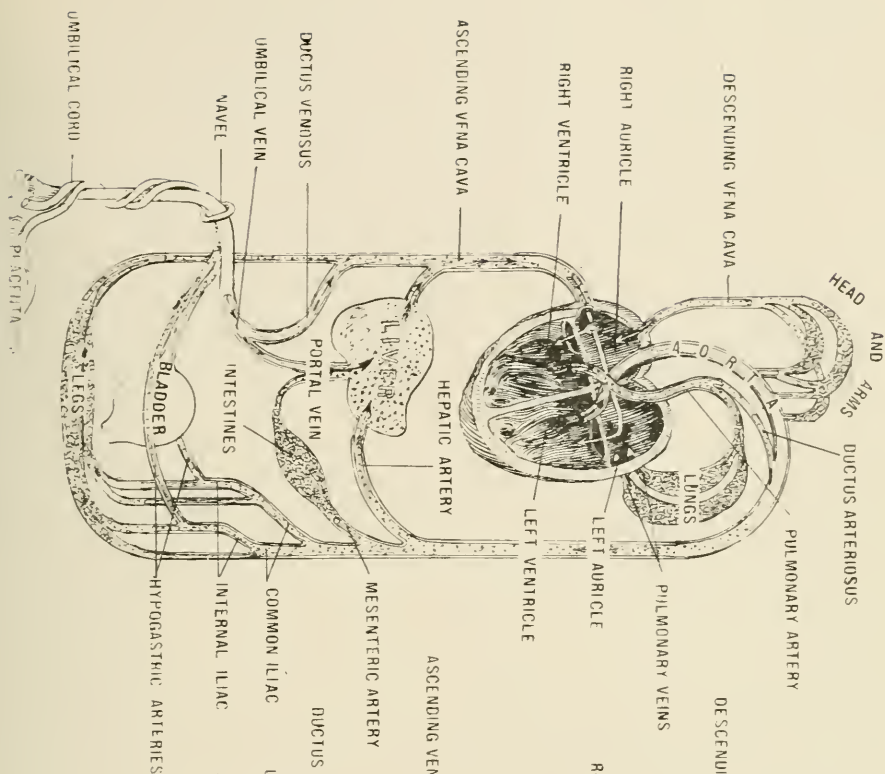
Ossification.—Its ossification is from two centers, one for the diaphysis, the sixth week, or may be as early as the thirtieth day, which is the first in the body, and the other at the sternal extremity, about the eighteenth or twentieth year, complete ossification taking place about the twenty-fifth year. It begins as a membranous bone, but the ossification later extends into the underlying cartilage.

Articulation.—(Plate XII.) It articulates with the sternum, the cartilage of the first rib and the acromion process of the scapula. The **sterno-clavicular articulation** is a reciprocal reception (saddle shaped-joint,) which belongs to the diarthrodial class and has all the movements except rotation. The **blood supply** of this joint is—(1) the internal mammary from the subclavian, (2) suprascapular from the thyroid axis, (3) superior thoracic from the first portion of the axillary, and occasionally twigs from a muscular branch from the subclavian which crosses the intersternal notch. The **nerve supply** to this joint is (1) the subclavian from the Brachial plexus and (2) the suprasternal from the Cervical plexus. The ligaments are the anterior sterno-clavicular ligament which is attached to the upper and anterior part of the manubrium; from here it passes to be attached to the upper and anterior part of the sternal extremity of the clavicle. The posterior sterno-clavicular ligament has a similar attachment from the posterior surfaces of the same bones. These two make the capsular ligament. The interarticular fibro-cartilage is thinner in the center than at the circumference and gives attachment to the sternal end of the clavicle above and the first costal cartilage at its junction with the manubrium below; thus it divides the synovial membrane, having one on each side.

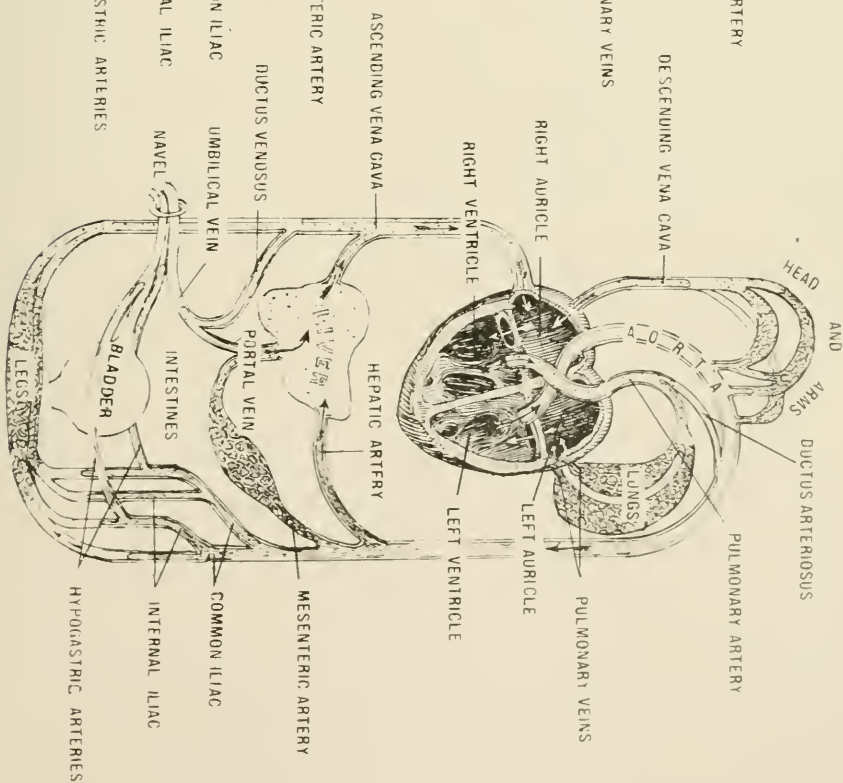
The **costo-clavicular** or rhomboid ligament passes upward, backward and outward from the sternal end of the cartilage of the first rib to the rhomboid impression of the clavicle. The inter-clavicular ligament is a flat cross-band attached to the upper margin of the manubrium, connecting the upper parts of the inner ends of the clavicle.

The **acromio-clavicular articulation** is an arthrodial joint. (Plate XIII.) The **blood supply** is (1) the suprascapular from the thyroid axis, (2) the acromio-thoracic and (3) posterior circumflex. The **nerve supply** is (1) circumflex from the posterior cord of the Brachial plexus, (2) suprascapular, from Brachial plexus and (3) supra-acromial from the Cervical plexus. The ligaments are the superior acromio-clavicular ligament, a quadrilateral band which passes between the outer end of the upper surface of the clavicle and the upper surface of the acromion process. The inferior acromio-clavicular ligament covers the joint below, but is thinner than the superior one. These two make the capsular ligament. The interarticular fibro-cartilage is not always present; it may fill the articulation, then there are two synovial membranes; more often it only occupies the upper part of the joint, then there is only one synovial membrane. The trapezoid ligament is the anterior and external part of the coraco-clavicular ligament and is attached above to the oblique line of the under surface of the clavicle and below to the posterior half of the upper surface of the coracoid process. The conoid ligament is the posterior and internal part of the coraco-clavicular ligament and is attached above

THE FETAL CIRCULATION.



THE ADULT CIRCULATION.



by its base to the conoid tubercle of the clavicle and a line running internally for half an inch; below by its apex to the rough impression at the base of the coracoid process.

BLOOD SUPPLY.—The nutrient artery of the clavicle is from the suprascapular. The acromial end receives a branch from the acromial thoracic artery and twigs from the arteries in the muscles attached to it.

LESSON VIII.

MUSCLES.

The muscles of the clavicle are six, viz., Sterno-cleido-mastoid, Sterno-hyoid, Subclavius, Pectoralis major, Deltoid, Trapezius, and occasionally the Sterno-thyroid.

Sterno-cleido-mastoid;—**DESCRIPTION.**—(Plate XIV.) This muscle passes obliquely across the side of the neck and is enclosed between the two layers of the deep cervical fascia. It is broad and thin at each extremity, but is thicker and narrower at the central portion. The portion which is attached to the sternum is directed upward, backward and outward. This attachment is tendinous in front and fleshy behind. The portion which is attached to the clavicle is directed almost vertically upward and is composed of fleshy and aponeurotic fibers. These two portions are separated at their origin, but become gradually blended below the middle of the neck into a thick, round muscle. The attachment of this muscle to the clavicle may be as small as the sternal attachment or it may extend to the attachment of the trapezius muscle at the outer portion of the clavicle. This muscle divides the quadrilateral space at the side of the neck into two triangles, an anterior and posterior.

ORIGIN.—By two heads; first from the anterior surface of the upper part of the manubrium of the sternum; the second from the inner one-third of the superior border and anterior surface of the clavicle. (Plate XI.)

INSERTION.—Mastoid process of temporal bone and the outer two-thirds or one half of the superior curved line of the occipital bone.

ACTION.—To depress and rotate head and elevate the thorax.

NERVE SUPPLY.—Spinal accessory (eleventh cranial) and deep branches of the cervical plexus (second and (third?) nerves.)

BLOOD SUPPLY.—The superior sterno-mastoid artery from the occipital artery, the middle sterno-mastoid artery from the superior thyroid artery, the inferior sterno-mastoid artery from the suprascapular artery, also branches from the posterior auricular artery.

Sterno-hyoid.—**Description.**—The sterno-hyoid covers the thyroid gland and upper part of the trachea, and is a thin narrow muscle, its lower portion being immediately beneath the Sterno-mastoid. This muscle comes in contact with its fellow in the middle of their course, and from there on lie side by side, but they are separated below from each other by a considerable interval.

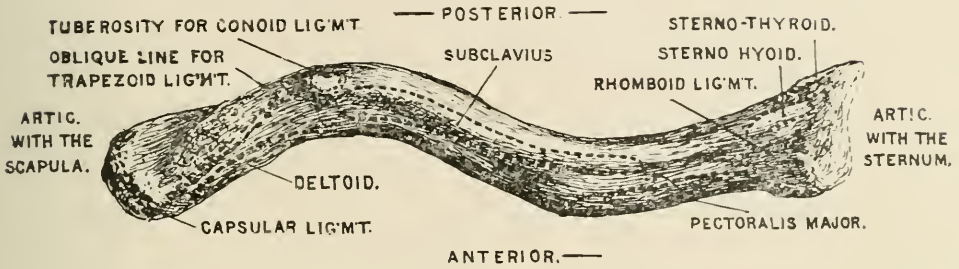
ORIGIN.—(1) Posterior surface of the manubrium of the sternum, (2) sternal end of the clavicle and posterior sterno-clavicular ligament.

INSERTION.—Body of the hyoid bone. (Plate XIX.)

ACTION.—To depress the hyoid bone.

NERVE SUPPLY.—Branches from loop of communication between the cervical plexus and the twelfth cranial nerve.

PLATE X.



LEFT CLAVICLE. INFERIOR SURFACE.

BLOOD SUPPLY.—Lingual, inferior and superior thyroid arteries.

Sterno-thyroid.—ORIGIN.—(1) Posterior surface of the manubrium of the sternum and the cartilage of the first rib, occasionally from the second rib and (2) sometimes from the clavicle.

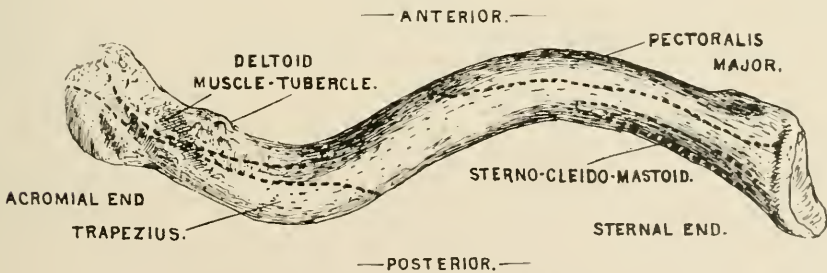
INSERTION.—Oblique line of ala of thyroid cartilage.

ACTION.—Depressor of larynx.

NERVE SUPPLY.—Branches from the loop of communication between the cervical plexus and the twelfth cranial nerve.

BLOOD SUPPLY.—Lingual, inferior and superior thyroid arteries.

PLATE XI.



LEFT CLAVICLE. SUPERIOR SURFACE.

Pectoralis major.—DESCRIPTION.—(Plate XV.)—This muscle is situated in front of the axilla, also on the upper and forepart of the chest. It is triangular, being both broad and thick. From its origin the fibers all pass towards its insertion, giving it the shape of a fan. Its tendon, which is flat, is about two inches in breadth. The tendon is made of two layers placed one in front of the other and usually blended together below. The anterior layer which is thicker receives the clavicular and upper half of the sternal portion of the muscle and its fibers are inserted in the same order as that in which they arise. The

posterior layer of the tendon receives the attachment of the lower half of the sternum and the deeper part of the muscle from the costal cartilages. These deep fibers, and particularly those of the lower costal cartilages ascend, the higher turning backward successively behind the superficial and upper ones, so that the tendon appears to be twisted. The posterior layer reaches higher on the humerus than the anterior one and from it an expansion is given off that covers the bicipital groove and blends with the capsule of the shoulder-joint. An expansion is given off, which lines the bicipital groove, from the insertion of the deeper fibers. An expansion passes downward to the fascia of the arm from the lower part of tendon. This muscle is separated from the Deltoid by slight interspaces in which lie the cephalic vein and the humeral branch of the axillary-thoracic artery. Its border forms the anterior margin of the axilla.

ORIGIN.—(1) The anterior surface of the sternal half of the clavicle. (2) Half the breadth of the anterior surface of the sternum as far down as the attachment of the cartilages of the sixth and seventh ribs. (3) Cartilages of all the true ribs, excepting the first and seventh, or both, and aponeurosis of the External oblique of the abdomen. (Plate XI.)

INSERTION.—The fibers which arise from the clavicle pass obliquely outward and downward; those from the lower part of the sternum and cartilages of the lower true ribs upward and outward, whilst the middle fibers pass horizontally. The tendon of termination is inserted into the outer bicipital ridge of the humerus. (Plate XXIII.)

ACTION.—Draws the arm forward and downward, also elevated the ribs in forced inspiration.

NERVE SUPPLY.—External and internal anterior thoracic. The nerves receive filaments from all spinal nerves entering into the formation of the brachial plexus.

The costo-coracoid membrane is a strong fascia situated in the interval between the Pectoralis minor and Subclavius muscles and protects the axillary vessels and nerves. It divides above to enclose the Subclavius muscle and its two layers are attached to the clavicle, one in front of and the other behind the muscle. The latter layer fuses with the deep clavicular fascia and with fascia of the axillary vessels. Internally, it blends with the fascia covering the first two intercostal spaces and is also attached to the first rib, internal to the origin of the Subclavius muscle. Externally it is very thick and dense and is attached to the coracoid process. This membrane is pierced by two arteries, two nerves, and two veins. The superior and axillary thoracic arteries, the external and internal anterior thoracic nerves, and the axillary thoracic and cephalic veins.

BLOOD SUPPLY.—Internal mammary, intercostals, superior thoracic, axillary thoracic, and long thoracic.

LESSON VIII.

Subclavius.—(Plate XV).—**DESCRIPTION.**—This is a small triangular muscle placed in the interval between the clavicle and the first rib. It is separated from the first rib by the subclavian vessels and brachial plexus of nerves. Its anterior surface is separated from the Pectoralis major by the costo-coracoid membrane, which with the clavicle, forms an osseo-fibrous sheath in which the

muscle is enclosed. The insertion of this muscle is larger than the origin.

ORIGIN.—By strong tendon from the first rib and its cartilage at their junction in front of the rhomboid ligament.

INSERTION.—Under surface of the clavicle in a deep groove about its middle third. (Plate XI.)

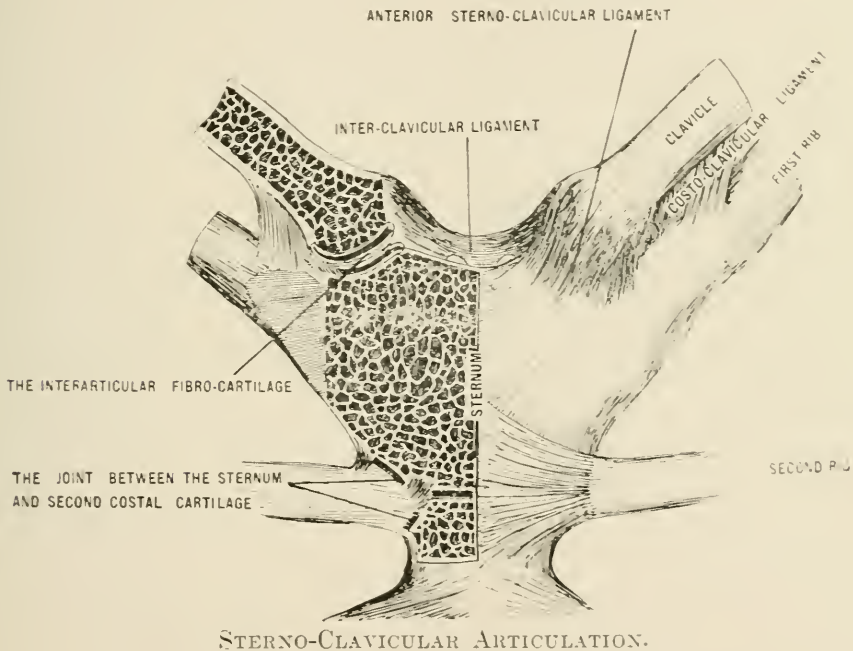
ACTION.—Depresses shoulder by drawing the clavicle downward and forward.

NERVE SUPPLY.—Filaments from the fifth and sixth cervical.

BLOOD SUPPLY.—First intercostal and short thoracic arteries.

Deltoid.—**DESCRIPTION.**—(Plates XVIII-XIV-XV-XVI.)—The Deltoid is a triangular muscle which gives the rounded outline to the shoulder. It is

PLATE XII.



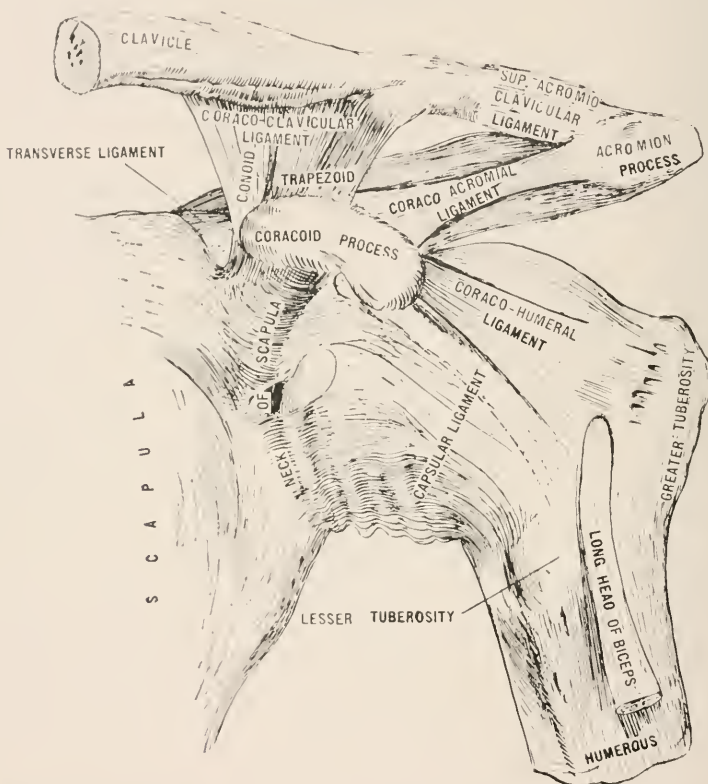
large and thick. It surrounds the shoulder-joint in the greater part of its of its extent, covering it on its outer side and in front and behind. Its deep surface is separated from the head of the humerus by a large sacculated synovial bursa. Its anterior border is separated at its upper part from the Pectoralis major by a cellular interspace which lodges the cephalic vein and the humeral branch of the acromial thoracic artery. This muscle is remarkably coarse in its texture.

ORIGIN.—(Plates XI-XX.)—(1) Outer third of anterior border and upper surface of clavicle. (2) Outer margin and upper surface of acromion process. (3) Lower lip of posterior border of spine of scapula as far back as the triangular surface at the inner end. The part arising from the acromion process

consists of oblique fibers which arise in a bipenniform manner from the sides of tendinous intersections, generally four in number, which are attached above to the acromion process and pass downward parallel to one another in the substance of the muscle. The portion of the muscle which arises from the clavicle and the spine of the scapula are not arranged in this manner, but pass directly from their origin to their insertion.

INSERTION.—(Plate XXIII.)—The fibers of this muscle converge towards their insertion, the middle passing vertically, the anterior obliquely backward, and the posterior obliquely forward; they unite to form a thick ten-

PLATE XIII.



ACROMIO-CLAVICULAR ARTICULATION AND SHOULDER-JOINT.

don which is inserted into a rough triangular prominence on the middle of the outer side of the shaft of the humerus. At its insertion is given off an expansion to the deep fascia of the arm. The oblique fibers arising from the tendinous intersections, generally three in number, pass upward from the intersection of the muscle and alternate with the descending septa.

ACTION.—To raise the arm and helps to draw it forward and backward.

NERVE SUPPLY.—Circumflex.

BLOOD SUPPLY.—Posterior circumflex and acromial thoracic arteries.

Trapezius.—DESCRIPTION.—(Plate XVIII.)—This is a broad, flat, triangular muscle, placed immediately beneath the skin and fascia, and covering the upper and back part of the neck and shoulders. It is fleshy in the greater part of its extent, but tendinous at its origin and insertion. At its origin, from the spines of the vertebrae, it is connected to the bones by means of broad semi-elliptical aponeurosis, which occupies the space between the sixth cervical and the third dorsal vertebra, and forms, with the aponeurosis of the opposite side, a tendinous ellipse.

ORIGIN.—(1) by thin fibrous laminae from the external occipital protuberance and the inner one-third or one-half of the superior curved line of the occipital bone. (2) from the ligamentum nuchae. (3) from spinous processes of the seventh cervical and all the dorsal vertebrae (4) and from the corresponding portion of the supraspinous ligament.

INSERTION.—(Plate XI-XX)—The superior fibers pass downward and outward and are inserted into the outer one-third of the posterior border of the clavicle varying greatly in the extent of its attachment, sometimes advancing as far as the middle of the clavicle, and may even become blended with the posterior edge of the Sterno-mastoid or overlapping it. The middle fibers pass horizontally outward and are inserted into the inner margin of the acromion process and superior lip of the posterior border or crest of the spine of the scapula. The inferior fibers pass upward and outward, converging near the scapula, and terminate in a triangular aponeurosis which glides over a smooth surface at the inner extremity of the spine, to be inserted into a tubercle at the outer part of this smooth surface.

ACTION.—When this muscle acts as a whole it lifts the shoulder and rotates the lower angle of the scapula outward. The upper part raises the shoulder, the middle part draws it toward the spine, and the lower part in pulling the scapula down and inward tilts the acromion process upward. If the shoulder girdle is fixed, this muscle will draw the head backward.

NERVE SUPPLY.—Spinal accessory and third and fourth cervical.

BLOOD SUPPLY.—Præceps cervicis from occipital, superficial cervical and posterior scapular from transversalis colli.

LESSON IX.

Scapula (Spade.)—(Plates XX-XXI.)—The scapula makes the posterior part of the shoulder-girdle. It is situated on the upper posterior part of the thorax, between the second rib above and the seventh or eighth ribs below, articulating with the clavicle by its acromion process laterally. This bone is made up of several triangles; first, the main part of the bone is triangular with two angles above and one below; the one next to the vertebral column is called the superior angle; the one nearest the clavicle is called the anterior or external angle and articulates with the humerus; the one near the seventh or eighth rib is the inferior angle. Being a triangle it will have two surfaces and three borders, as well as three angles. The **anterior surface** or venter is concave, deepest where the upper one-fourth joins the lower three-fourths; this is to give more room.

for the Subscapularis muscle; this surface is also called the subscapular fossa. On this surface there are several oblique lines running from the vertebral border upward and outward, for the attachment of the fascia of the Subscapularis. The vertebral aspect of this surface gives attachment to the Serratus magnus, which attachment is triangular above and below with a long narrow attachment between. The **posterior surface**, or dorsum, as a whole is convex. It is separated into two parts by a second triangle, which is called the spine of the scapula. The part above the spine is called the supraspinous fossa and is for the Supraspinatus muscle, and the part below is the infraspinous fossa and is for the Infraspinatus muscle. This spine separates the upper one-fourth from the lower three-fourths opposite the deepest part of the subscapular fossa. The **superior border** is the shortest and has a notch called the suprascapular notch, which is about at the junction of the external one-third with the internal two-thirds. This notch transmits the suprascapular nerve and is crossed by the transverse ligament of the scapula. The outer extremity of this border is continued as the coracoid process which may be called a third triangle or rather pyramid; it gives attachment to three muscles, the short head of the Biceps, Coraco-brachialis, and Pectoralis minor. The **vertebral or posterior border** is the longest and is called the base; it has three muscles attached to it, the Levator anguli scapulae, and the Rhomboideus minor and major. The **axillary border** is the thickest of the three and would be the longest of the borders if it were continued to meet the superior border. It has three muscles attached, the Teres major and minor and the long head of the Triceps. Then with the axillary border continued to meet the superior border we have a triangle whose base is the vertebral border, whose altitude is the superior border and whose hypotenuse is the axillary border continued, and in this case would be the longest. There is a groove on the axillary border at the junction of the upper one-third with the lower two-thirds, for the dorsalis scapulae artery, and an oblique line separating the attachments of the Teres minor and major. The **spine** represented as a triangle will have its base, the anterior border, attached to the dorsum of the scapula from a point about one-fourth the distance from the vertebral border to the glenoid fossa to within half an inch of the glenoid fossa; the portion between the spine and the glenoid fossa is the great scapular notch. The **glenoid fossa** is the deficiency between the superior and axillary borders, with which the head of the humerus articulates. The **altitude** is the external border, called by some authors the base; the posterior border or crest represents the hypotenuse of the triangle. The **crest**, posterior border, or hypotenuse is continued outward as the acromion process of the scapula and is somewhat triangular. Its upper lip gives attachment for the Trapezius and the lower lip to the Deltoid muscle. This process articulates with the clavicle and gives attachment for the ligaments of that articulation, besides to the coraco-acromial ligament. Between the spine of the scapula and the vertebral border is a smooth surface for the Trapezius to glide over.

Ossification.—The scapula has seven centers of ossification, occasionally it has nine centers. One for the body of the scapula makes its appearance about the eighth week of intrauterine life; the one for the posterior border and also

- 1 - OCCIPITO FRONTALIS.
- 2 - ORBICULARIS PALPEBRARUM.
- 3 - CORRUGATOR SUPERCILII.
- 4 - PYRAMIDALIS.
- 5 - COMPRESSOR NARIS.
- 6 - COMPRESSOR NARIUM MINOR.
- 7 - DILATOR NARIS ANT.

- 31 - STERNO CLEIDO MASTOID.
- 32 - STERNO HYOID.
- 33 - OMO HYOID.
- 34 - THYRO HYOID.

- 35 - STERNO THYROID
- 36 - INF. CONSTRICTOR.
- 37 - SCALENUS MEDIUS.
- 38 - SCALENUS POSTICUS
- 39 - LEVATOR ANGULI SCAPULÆ.
- 40 - SPLENIUS CAPITIS ET-COLLI.

41 - TRAPEZIUS.

42 - APONEUROSIS

43 - EXT. LATERAL LIG

44 - HYOID BONE

45 - ZYGOMA.

46 INF. MAXILARY.

47 CLAVICLE.

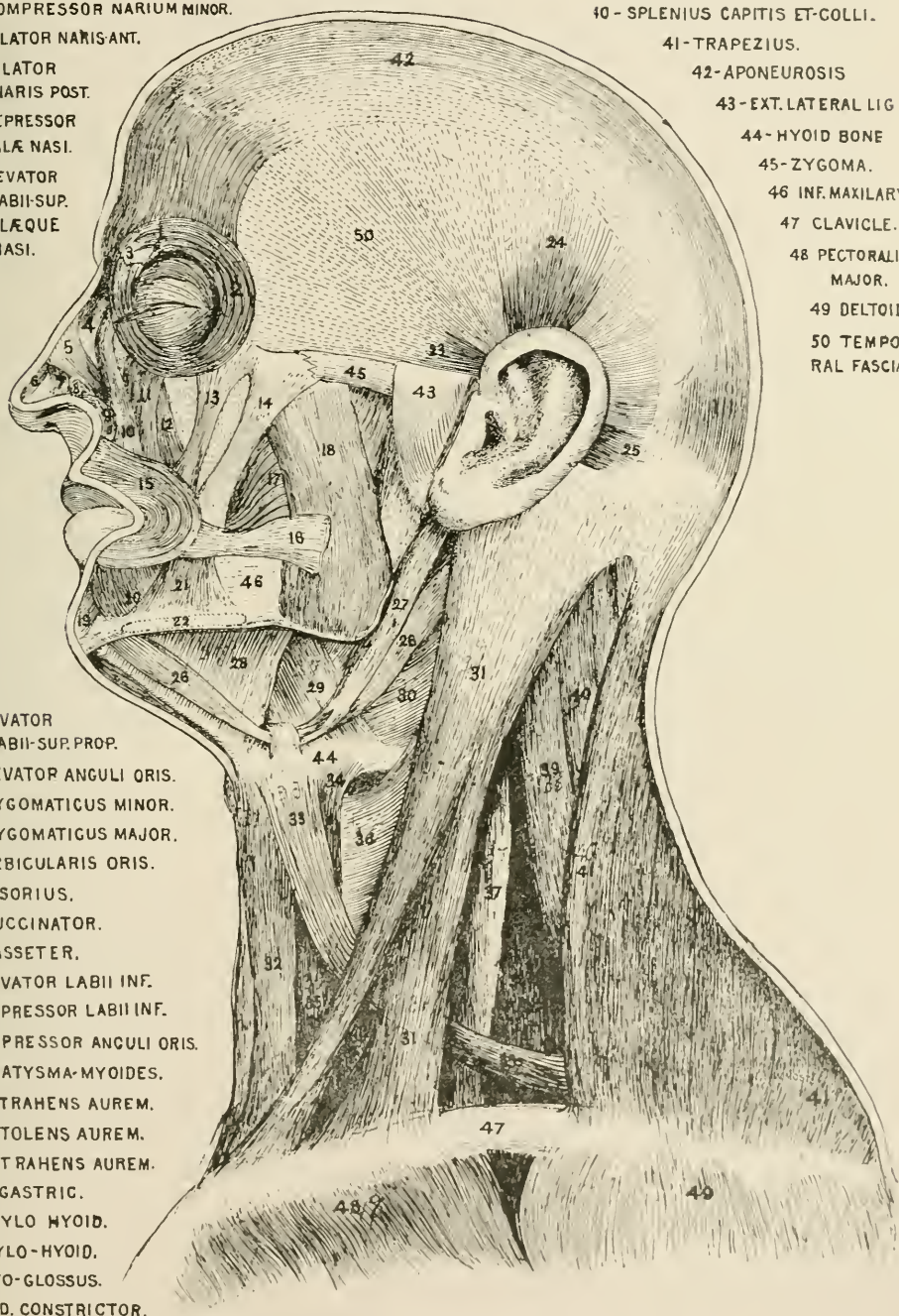
48 PECTORALIS MAJOR.

49 DELTOID.

50 TEMPO-
RAL FASCIA

- 10 - LEVATOR LABII SUP.
- ALÆ QUE NASI.

- 11 - LEVATOR LABII SUP. PROP.
- 12 - LEVATOR ANGULI ORIS.
- 13 - ZYGOMATICUS MINOR.
- 14 - ZYGOMATICUS MAJOR.
- 15 - ORBICULARIS ORIS.
- 16 - RISORIVS.
- 17 - BUCCINATOR.
- 18 - MASSETER.
- 19 - LEVATOR LABII INF.
- 20 - DEPRESSOR LABII INF.
- 21 - DEPRESSOR ANGULI ORIS.
- 22 - PLATYSMA-MYOIDES.
- 23 - ATTRAHENS AUREM.
- 24 - ATTOLENS AUREM.
- 25 - RETRAHENS AUREM.
- 26 - DIGASTRIC.
- 27 - STYLO HYOID.
- 28 - MYLO-HYOID.
- 29 - HYO-GLOSSUS.
- 30 - MID. CONSTRICTOR.



MUSCLES OF FACE AND TRIANGLES OF NECK

the one for the inferior angle appear about the 15th year and join the body of the scapula the 25th year. There are two for the acromion process which appear the 15th year and join the body of the scapula the 20th year. The coracoid process has two centers, the one at the base of the process appears at the 10th year and the other during the 1st year; they both join the body of the scapula the 25th year.

Articulation.—It articulates with the clavicle, (a description of which is given in Lesson VII.) and with the humerus, making the shoulder-joint. This joint is a diarthrodial joint and belongs to the sub-class enarthrodial (ball-and-socket.) Plate XIII.)

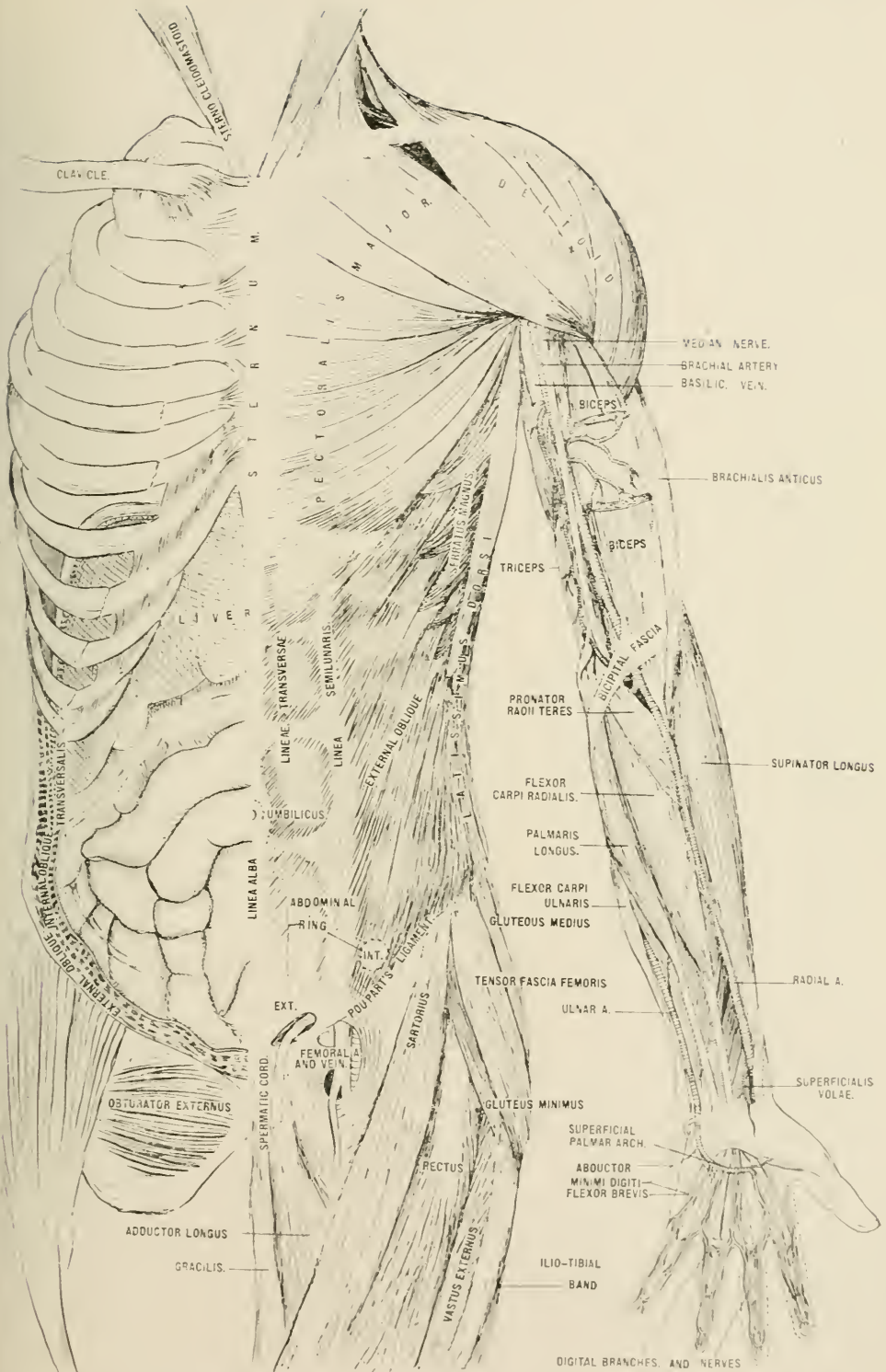
Blood supply of the shoulder-joint is (1) suprascapular from the thyroid axis, (2) anterior circumflex, (3) posterior circumflex, and (4) subscapular. The last three are from the third part of the axillary artery.

Nerve supply.—(1) Suprascapular and (2) circumflex, both are branches from the Brachial plexus.

Ligaments.—The true ligaments of the scapula are the transverse or suprascapular which passes over the suprascapular notch separating the suprascapular nerve from the suprascapular vessels above. The coraco-acromial ligament, which is triangular, is attached by its base to the entire outer border of the coracoid process, and by its apex to the tip of the acromion process.

The ligaments of the shoulder-joint are (1) The **capsular** which is very loose and permits free movements of the joint. It is attached to the circumference of the glenoid cavity and to the anatomical neck of the humerus. This is thickest above. It may have three openings in it, one for the long head of the Biceps between the two tuberosities, another below the coracoid process, partially filled by the tendon of the Subscapularis and a third (which is not always present) for the tendon of the Infraspinatus muscle. These openings are for the communication between the synovial membranes of the joint and the bursæ beneath the tendons. A bursa is a sac or pouch.

The long head of the Biceps is a ligament. On the inner and anterior aspect of the capsular ligament are three gleno-humeral ligaments, thickened portions of the capsular ligament. (a) The upper one of these is called Flood's ligament, (b) the middle one is the internal brachial of Schlemm and (c) the inferior is called the broad ligament of Schlemm. (2) The **coraco-humeral** or accessory ligament, is also a part of the capsular ligament; it is attached to the outer border of the base of the coracoid process above and to the great tuberosity of the humerus below. (3) The **transverse ligament** passes over the bicipital groove, holding down the long head of the Biceps. (4) The **glenoid** ligament is a continuation of the long head of the Biceps which makes the glenoid fossa deeper and it joins the long head of the Triceps below. It is narrow at the circumference, but broad at its base. It is a fibro-cartilaginous rim. A synovial membrane lines these joints and is reflected through the opening in the capsule and over the long head of the Biceps in the groove.



EXTERNAL OBLIQUE MUSCLE OF ABDOMEN AND NUMEROUS OTHER STRUCTURES.

LESSON X.

MUSCLES.—There are seventeen muscles attached to the scapula.

THREE TO THE VERTEBRAL BORDER—	THREE TO THE FOSSÆ—
Levator anguli scapulae;	Supraspinatus—in the supraspinous
Rhomboideus minor;	fossa;
Rhomboideus major.	Infraspinatus—in the infraspinous
TWO TO ACROMION PROCESS—	fossa;
Trapezius:.	Subscapularis—in the subscapular
Deltoid.	fossa.
THREE TO THE AXILLARY BORDER—	THREE TO THE CORACOID PROCESS—
Long head of the Triceps;	Short head of Biceps;
Teres minor;	Coraco-brachialis;
Teres major.	Pectoralis minor.
THREE IRREGULARLY ARRANGED—	

Omo-hyoid, near transverse ligament:

Serratus magnus, on the vertebral aspect of the venter:

Latissimus dorsi, on the inferior angle, dorsal aspect.

When all the muscles of the clavicle and scapula are given, we have all the muscles in the upper extremity as far as the elbow, except the Brachialis anticus. (Plate XVI.)

Pectoralis minor.—DESCRIPTION.—(Plate XVI.)—This is a thin, flat, triangular muscle situated at the upper part of the thorax beneath the Pectoralis major. Its upper border is separated from the clavicle by a triangular interval, broad internally, narrow externally, which is occupied by the costo-coracoid membrane. In this space is the first part of the axillary vessels and nerves. Running parallel to the lower border of the muscle is the long thoracic artery.

ORIGIN.—Upper margin and outer surface of the third, fourth and fifth ribs near cartilages, and aponeurosis covering the Intercostal muscles.

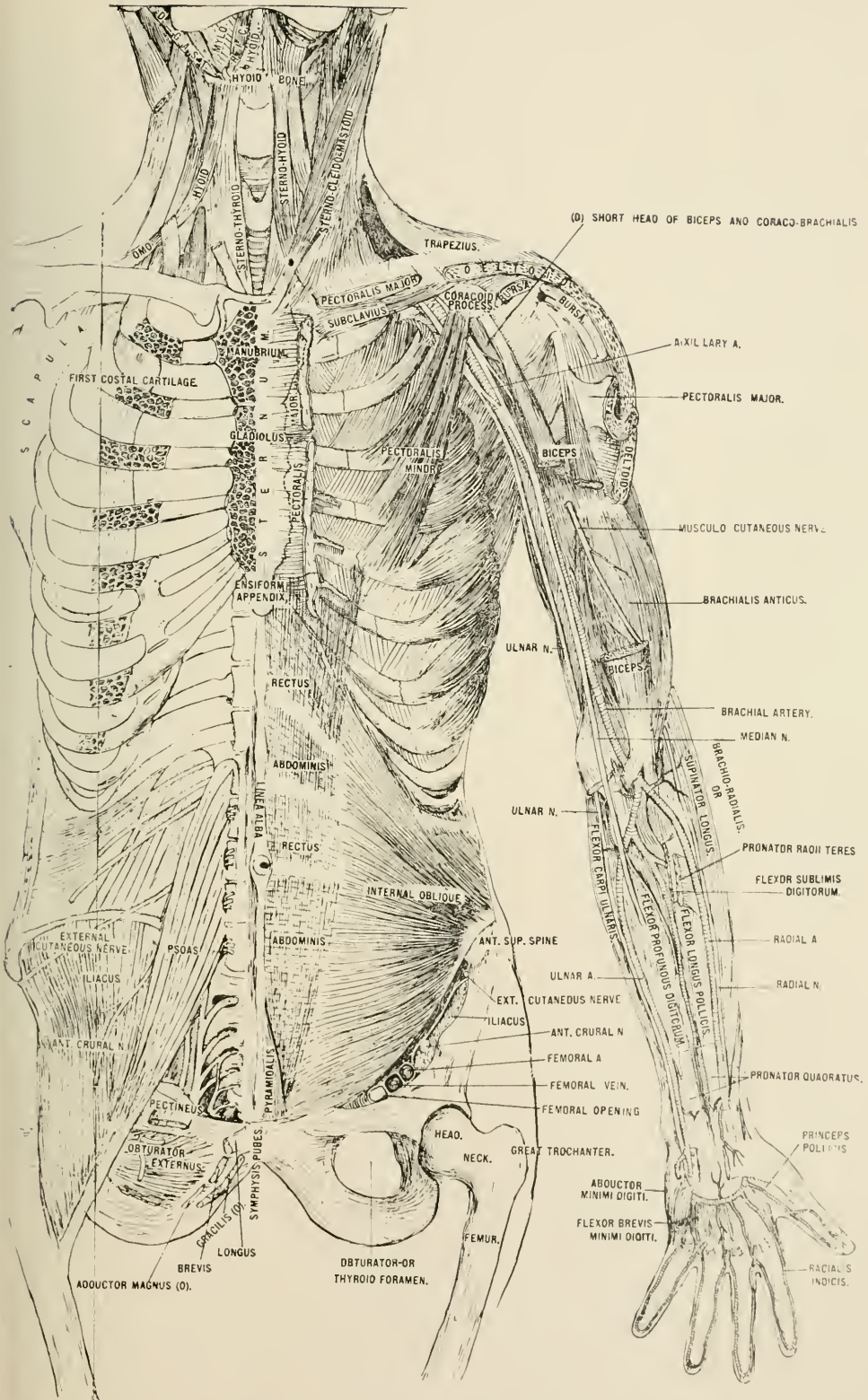
INSERTION.—The fibers converge and form a flat tendon which is inserted into the inner border and upper surface of the coracoid process of the scapula. (Plate XXI.)

ACTION.—To depress the point of the shoulder and aids in forced inspiration.

NERVE SUPPLY.—Internal anterior thoracic, the filaments being derived from the eighth cervical and first dorsal nerves.

BLOOD SUPPLY is from the internal mammary, intercostals, superior thoracic, acromial thoracic, and long thoracic.

Triceps.—DESCRIPTION.—(Plate XVIII.)—The Triceps is situated at the back of the arm, extending the entire length of the posterior surface of the humerus. It is of large size and divided above into three parts, hence its name. These portions have been named (1) the middle, scapular, or long head; (2)



INTERNAL OBLIQUE MUSCLE OF ABDOMEN AND NUMEROUS OTHER STRUCTURES

the external, or long humeral; and (3) the internal, or short humeral head. The common tendon of the Triceps commences about the middle of the back part of the muscle; it consists of two aponeurotic laminae, one of which is subcutaneous and covers the posterior surface of the muscle for the lower half of its extent; the other is more deeply seated in the substance of the muscle. After receiving the attachment of the muscular fibers they join together above the elbow, forming the tendon of insertion. A small bursa is situated beneath the tendon.

ORIGIN.—The middle or long head arises from a rough triangular depression on the scapula, just below the glenoid cavity, being blended at its upper part with the capsular ligament. (Plate XXI.)

The external head arises from the posterior surface of the shaft of humerus, between the insertion of the Teres minor and the upper part of the musculo-spiral groove; also from the external border of the humerus and external intermuscular septum. (Plate XXII.)

The internal head arises from the posterior surface of shaft of humerus, below the groove for the musculo-spiral nerve, extending from the insertion of the Teres major to within an inch of the trochlear surface; also from the internal border of the humerus and from the back of the whole length of the internal and lower part of the external intermuscular septum. (Plate XXII.)

INSERTION.—Upper end of olecranon process of ulna, a band of fibers being continued downward to blend with the deep fascia of forearm. (Plate XXIV.)

ACTION.—Extensor of forearm.

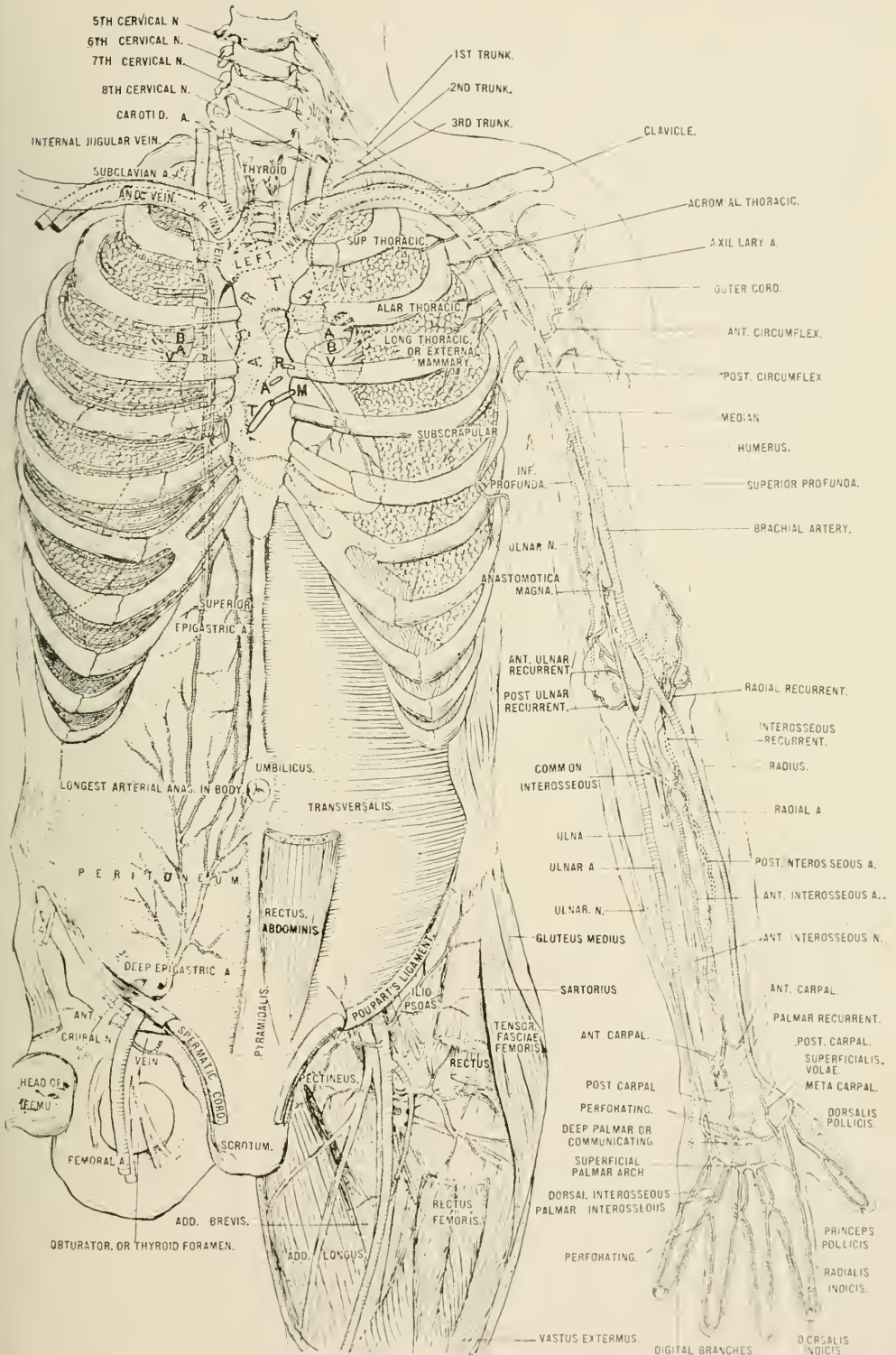
NERVE SUPPLY.—Seventh and eighth cervical through musculo-spiral.

BLOOD SUPPLY.—Brachial and superior profunda.

Latissimus dorsi.—**DESCRIPTION.**—(Plate XVIII.)—This is a broad, flat muscle which covers the lumbar and lower half of the dorsal regions and is gradually contracted into a narrow fasciculus which passes upward across the inferior angle of the scapula, and occasionally receives a few fibers from it. It belongs to the first layer of muscles in the back.

The muscle then curves around the lower border of the Teres major, and is twisted upon itself. It terminates in a short, quadrilateral tendon, about three inches in length, which, as it passes in front of the tendon of the Teres major becomes united with it, the surfaces of the two being separated by a bursa; another bursa is sometimes interposed between the muscle and the inferior angle of the scapula. At the insertion of this muscle an expansion is given off to the deep fascia of the arm. There is usually a fibrous slip which passes from the lower border of the tendon of the Latissimus dorsi, near its insertion, to the long head of the Triceps. This is occasionally muscular and is the representative of the Dorso-epitrochlearis muscle of apes.

ORIGIN.—From the spinous processes of the six inferior dorsal vertebrae, and from the posterior layer of the lumbar fascia, by which it is attached to the spines of the lumbar and sacral vertebrae, and to the supraspinous ligament, also from the external lip of the crest of the ilium behind the origin of the external oblique, and by fleshy digitations from the three or four lower ribs, which



TRANSVERSALIS MUSCLE OF ABDOMEN AND NUMEROUS OTHER STRUCTURES

are interposed between similar processes of the External oblique muscle. The upper fibers pass longitudinally outward, the middle fibers obliquely upward, and the lower fibers vertically upward, converging at the inferior angle of the scapula. (Plate XX.)

INSERTION.—Into the bottom of the bicipital groove of the humerus, its insertion extending higher than that of the Pectoralis major. (Plate XXIII.)

ACTION.—Draws the arm down and back, raises the lower ribs, and draws the trunk forward.

NERVE SUPPLY.—Middle or long subscapular.

BLOOD SUPPLY.—Subscapular artery.

Serratus magnus.—**DESCRIPTION.**—(Plates XV-XVIII.)—This is a thin irregularly quadrilateral muscle situated between the ribs and scapula at the upper and lateral part of the chest. It is partly covered in front by the Pectoral muscles, behind by the Subscapularis. The axillary vessels and nerves lie upon its upper part, while its deep surface rests upon the ribs and intercostal muscles.

ORIGIN.—By nine digitations or slips from the outer surface and upper border of the eight upper ribs (the second rib giving origin to two slips,) and from the aponeurosis covering the corresponding intercostal muscles. The fibers pass backward closely applying the chest wall and the vertebral border of the scapula. The lower four slips interdigitate at their origin with the upper five slips of the External oblique muscle of the abdomen.

INSERTION.—The slips from the first and the higher of the two from the second rib, converge to be inserted into the triangular area on the ventral aspect of the superior angle of the scapula. The next two slips spread out to form a thin triangular sheath, the base of which is directed backward and is inserted into nearly the whole length of the ventral aspect of the vertebral border of the scapula. The lower slips converge as they pass backward from the ribs and form a fan-shaped structure, the apex of which is inserted, partly by muscular and partly by tendinous fibers, into the triangular impression on the ventral aspect of the inferior angle. (Plate XXI.)

ACTION.—A pushing muscle. It also raises the point of the shoulder.

NERVE SUPPLY.—Posterior thoracic which is derived from the fifth, sixth, and seventh cervical nerves.

BLOOD SUPPLY.—Intercostals, long and short thoracic.

LESSON XI.

Levator anguli scapulae.—**DESCRIPTION.**—(Plate XVIII.)—This muscle lies just beneath the Trapezius at the back part and side of the neck.

ORIGIN.—By tendinous slips from the transverse process of the atlas, and from the posterior tubercles of the transverse processes of the second, third, and fourth cervical vertebrae. These slips become fleshy and unite so as to form a flat muscle which passes downward and backward to its insertion.

INSERTION.—Into the posterior border of the scapula between the superior

angle and the triangular smooth surface at the root of the spine. (Plate XX.)

ACTION.—To raise the superior angle of the scapula.

NERVE SUPPLY.—Third and fourth cervical, and frequently by a branch from the nerve to the Rhomboidei.

BLOOD SUPPLY.—Vertebral, ascending cervical, superficial cervical, and posterior scapular.

Rhomboideus minor.—(Plate XVIII.)—**ORIGIN.**—Ligamentum nuchæ and spinous processes of the seventh cervical and first dorsal vertebræ.

INSERTION.—Smooth surface at root of spine of scapula. (Plate XX.)

ACTION.—To draw the scapula backward and upward.

NERVE SUPPLY.—Fifth cervical.

BLOOD SUPPLY.—Posterior scapular.

Rhomboideus major.—(Plate XVIII.)—**DESCRIPTION.**—This muscle is situated immediately below the minor, the adjacent margins of the two being occasionally united.

ORIGIN.—Spinous processes of the four or five upper dorsal vertebrae and the supra-spinous ligament.

INSERTION.—Into a narrow tendinous arch attached above to the lower part of the triangular surface at the root of the spine, and below to the inferior angle, the arch being connected to the border of the scapula by a thin membrane. When the arch extends but a short distance, as it occasionally does, the muscular fibers are inserted into the scapula itself. (Plate XX.)

ACTION.—To draw scapula backward and upward.

NERVE SUPPLY.—The fifth cervical.

BLOOD SUPPLY.—Posterior scapular.

Supraspinatus.—**DESCRIPTION.**—(Plates XXVIII-XVIII.)—The supraspinatus muscle occupies the whole of the supraspinous fossa. The fibers converge to a tendon which passes across the upper part of the capsular ligament of the shoulder joint, to which it is intimately adherent.

ORIGIN.—(1) Internal two-thirds of supraspinous fossa. (2) Strong fascia covering surface of fossa. (Plate XX.)

INSERTION.—Upper facet of greater tuberosity of humerus. (Plate XXIII.)

ACTION.—Raises arm and supports tuberosity of humerus.

NERVE SUPPLY.—Fifth and sixth cervical through the suprascapular nerve.

BLOOD SUPPLY.—Suprascapular artery.

Infraspinatus.—**DESCRIPTION.**—(Plates XXVIII-XVIII.)—This is a thick, triangular muscle which occupies the chief part of the infraspinous fossa. The fibers converge to a tendon which glides over the external border of the spine of the scapula and passes over the posterior part of the capsular ligament of the shoulder-joint. This tendon is occasionally separated from the spine of the scapula by a synovial bursa which communicates with the synovial cavity of the shoulder-joint.

ORIGIN.—(1) Internal two-thirds of infraspinous fossa; (2) tendinous fibers from ridges on its surface; (3) strong fascia covering it externally and separating it from the Teres major and minor. (Plate XX.)

INSERTION.—Middle facet of greater tuberosity of humerus. (Plate XXII.)

ACTION.—Rotates head of humerus outward.

NERVE SUPPLY.—Fifth and Sixth cervical through the suprascapular nerve.

BLOOD SUPPLY.—Suprascapular artery.

Subscapularis.—**DESCRIPTION.**—The subscapular fascia is a thin membrane attached to the entire circumference of the subscapular fossa, and affording attachment by its inner surface to some of the fibers of the Subscapularis muscle. The Subscapularis is a large triangular muscle which fills up the subscapular fossa. The muscle terminates in a tendon which is in close contact with the anterior part of the capsular ligament of the shoulder-joint and glides over a large bursa, which separates it from the base of the coracoid process. This bursa communicates with the cavity of the joint by an aperture in the capsular ligament. Its anterior surface forms a considerable part of the posterior wall of the axilla, and its lower border is contiguous with the Teres major and Latissimus dorsi muscles.

ORIGIN.—(Plate XXI.)—From the inner two-thirds of the subscapular fossa, with the exception of a narrow margin along the posterior border, and the surfaces at the superior and inferior angles; also from the lower two-thirds of the groove on the axillary border of the bone. Some fibers arise from tendinous laminae, which intersect the muscle, and are attached to ridges on the bone, and others form an aponeurosis which separates the muscle from the Teres major and the long head of the Triceps.

INSERTION.—Lesser tuberosity of the humerus. (Plate XXIII.)

ACTION.—Rotates head of humerus inward.

NERVE SUPPLY.—Upper and lower subscapular (first and third.)

BLOOD SUPPLY.—Subscapular artery.

Teres minor.—(Plates XXVIII-XVIII.)—**DESCRIPTION.**—This is a narrow, elongated muscle lying between the Infraspinatus and Teres major, being separated from the latter anteriorly by the long head of the Triceps.

ORIGIN.—Upper two-thirds of dorsal surface of axillary border of the scapula and from the two aponeurotic laminae, one of which separates it from the Infraspinatus, the other from the Teres major. (Plate XX.)

INSERTION.—Lower facet on greater tuberosity of humerus and bone below. (Plate XXII.)

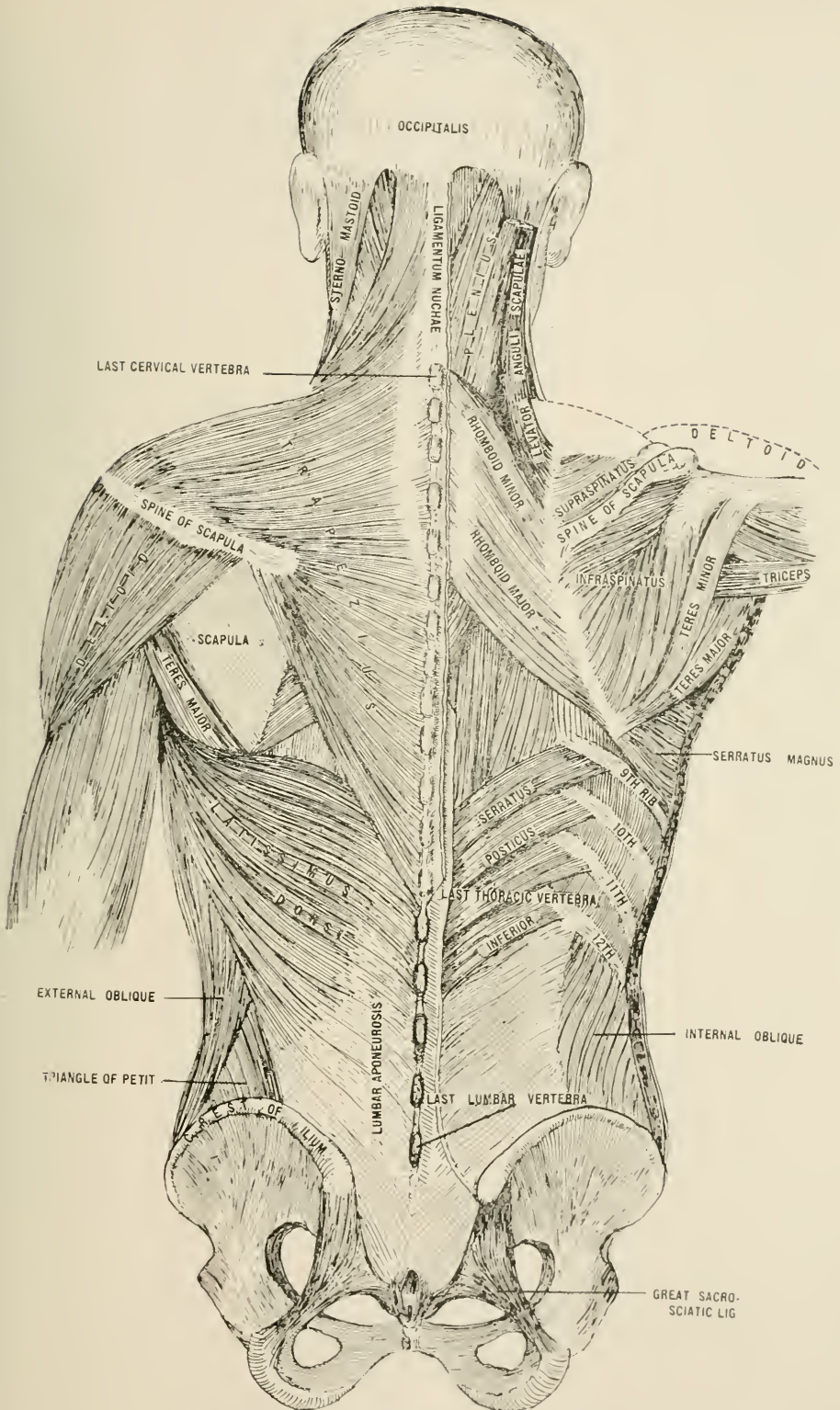
ACTION.—Rotates head of humerus outward.

NERVE SUPPLY.—Fifth cervical through the circumflex.

BLOOD SUPPLY.—Infrascapular from dorsalis scapulae, circumflex arteries.

LESSON XII.

Teres major.—**DESCRIPTION.**—(Plates XXVIII-XVIII.)—This is a thick, but somewhat flattened muscle, lying immediately below the Teres minor. Its fibers are directed upward and outward and terminate in a tendon about two inches in length. This tendon, at its insertion, lies behind that of the Latissimus dorsi, from which it is separated by a synovial bursa, the two tendons, however, being united along their borders for a short distance. The axillary vessels and the brachial plexus of nerves lie upon its anterior surface. Its



MUSCLES OF BACK—SUPERFICIAL LAYERS

lower border forms, in conjunction with the Latissimus dorsi, part of the posterior boundary of the axilla.

ORIGIN.—From the oval surface on the dorsal aspect of the inferior angle of the scapula, and from the fibrous septa interposed between it and the Teres minor and Infraspinatus. (Plate XX.)

INSERTION.—Inner bicipital ridge of humerus. (Plate XXIII.)

ACTION.—Assists Latissimus dorsi in drawing humerus downward and backward.

NERVE SUPPLY.—Fifth and sixth cervical through the lower subscapular.

BLOOD SUPPLY.—Subscapular artery.

Coraco-brachialis.—**DESCRIPTION.**—This is the smallest of the three muscles in the ant. humeral region, and is situated at the upper and inner part of the arm. Its fibers pass downward, backward, and a little outward, and terminate in a flat tendon. This muscle is perforated by the musculo-cutaneous nerve and its inner border forms a guide to the position of the brachial artery in tying this vessel in the upper part of its course. The brachial vessels and median nerve lie upon its anterior surface at its insertion. (Plate XVI.)

ORIGIN.—Apex of coracoid process in common with short head of Biceps. (Plate XXI.)

INSERTION.—Ridge on inner side of shaft of humerus about its middle, between the origins of the Triceps and Brachialis anticus. (Plate XXIII.)

ACTION.—Draws the humerus forward and inward and assists in elevating the same.

NERVE SUPPLY.—Seventh cervical through the Musculo-cutaneous.

BLOOD SUPPLY.—Brachial, muscular branches.

Biceps.—**DESCRIPTION.**—(Plates III-XV-XVI.)—The Biceps is a long fusiform muscle, occupying the whole of the anterior surface of the arm, and divided above into two portions or heads, from which circumstance it has received its name. Each head is tendinous but is succeeded by an elongated muscular belly, and the two bellies, although closely applied to each other, may readily be separated until within about three inches of the elbow-joint. Here they end in a flattened tendon, a synovial bursa being interposed between it and the front of the tuberosity of the radius. As this tendon approaches the radius it becomes twisted upon itself so that its anterior surface becomes external. Opposite the bend of the elbow it gives off, from its inner side, a broad aponeurosis, the bicipital fascia (semilunar fascia,) which passes obliquely downward and is continuous with the deep fascia of the forearm. The Biceps muscle occasionally has a third head which may consist of two slips passing down, one in front of the other behind the brachial artery, concealing this vessel in the lower half of the arm.

The inner border of the Biceps forms a guide to the position of the artery in tying that vessel in the middle of the arm.

ORIGIN.—(Plates XX-XXI.)—The long head arises from the upper margin of the glenoid cavity and is continuous with the glenoid ligament. The tendon arches over the head of the humerus, being enclosed in a special sheath of synovial membrane, passes through an opening in the capsular ligament and

descends in the bicipital groove, in which it is retained by a fibrous prolongation from the tendon of the *Pectoralis major*.

The short head arises from the apex of the coracoid process in common with the *Coraco-brachialis*.

INSERTION.—Back of tuberosity of radius; fascia of forearm. (Plate XXV.)

ACTION.—Flexes and supinates forearm, and tenses fascia.

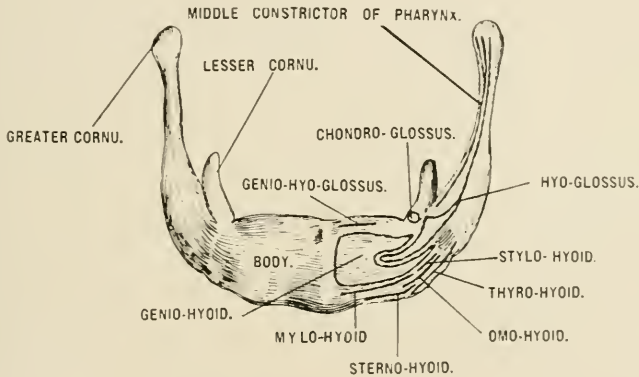
NERVE SUPPLY.—Fifth and sixth cervical through the musculo-cutaneous.

BLOOD SUPPLY.—Brachial artery, muscular branches.

Omo-hyoid—**DESCRIPTION.**—This muscle passes from near the suprascapular notch of the scapula to the hyoid bone, thus dividing the anterior and posterior triangles of the neck into two triangles each. (Plate XIV.)

ORIGIN.—From the superior border of the scapula, internal to the suprascapular notch. (Plate XX.)

PLATE XIX.



THE HYOID BONE

INSERTION.—Into the lower border of the body of hyoid bone. (Plate XIX.)

BLOOD SUPPLY.—Lingual and superior thyroid from the external carotid, and the inferior thyroid from the thyroid axis.

ACTION.—Depresses hyoid bone.

NERVE SUPPLY.—Branches from the loop between the cervical plexus and the 12th cranial nerve.

BLOOD SUPPLY OF SCAPULA.—The glenoid fossa, supraspinous fossa, infraspinous fossa and the spine all get the suprascapular artery from the thyroid axis. The infraspinous fossa, in addition, receives the dorsalis scapulae which is a branch of the subscapular, from the third portion of the axillary. The acromion process is supplied by branches from the acromial thoracic artery. The venter receives the subscapular, and a subscapular branch from the suprascapular; and the vertebral border receives the posterior scapular from the suprascapular.

LESSON XIII.

Humerus.—(Plates XXII-XXIII.)—The humerus is the longest bone in the upper extremity, and is the only one in the arm. Its upper extremity consists of a head, neck and two tuberosities, a greater and lesser. The head is directed inward, upward and backward; on this account one can lift his arm higher when brought a little forward than when at right angles to the body; the head is about a hemisphere. The contracted part below the head is called the anatomical neck; it is rarely broken, while the part below the tuberosity is called the surgical neck on account of it being the seat of fracture. Between the two necks are the tuberosities, the greater on the outer aspect of the bone, separated from the lesser by the bicipital groove which is for the long head of the Biceps.

The greater tuberosity has three facets, the upper one for the Supraspinatus muscle, the middle one for the Infraspinatus muscle, and the lower one for the Teres minor. The lesser tuberosity is in the form of a cone and has attached to it the Subscapularis. The bicipital groove extends about one-fourth the way down the bone; its outer ridge is also anterior and is for the attachment of the Pectoralis major; the inner ridge is posterior and is for the attachment of the Teres major; the groove has the Latissimus dorsi attached. The diaphysis is somewhat triangular on cross section and has three surfaces and three borders.

The anterior border extends from the front of the great tuberosity to the coronoid depression below, separating the external from the internal surfaces; its upper part is the external bicipital ridge for the insertion of the Pectoralis major muscle; the lower part is covered by the Brachialis anticus. The external border extends from the posterior part of the great tuberosity to the external condyle, and separates the external and posterior surfaces; its lower part is the supracondylar ridge. From above downward it has attached the lower part of the Teres minor on the posterior aspect, the middle or long humeral head of the Triceps separated from the short head of the same by the musculospiral groove which transmits the musculospiral nerve and the superior profunda artery. The external supracondylar ridge has attached the external intermuscular septum which gives attachment to five muscles, viz., Deltoid, Brachialis anticus, Triceps, Supinator longus, and Extensor carpi radialis longior. The internal border extends from the inner part of the lesser tuberosity to the internal condyle, separating the internal and posterior surfaces. From above downward it has the Teres major, and Coraco-brachialis.

Below the insertion of the Coraco-brachialis is the canal for the nutrient artery, which runs towards the distal extremity of the bone (Page 19, Lesson 1.) a second canal is often present on the posterior surface; its artery comes from the superior profunda. The internal intermuscular septum is attached to the internal supracondylar ridge and has attached to it three muscles, viz., Triceps, Brachialis anticus, Coraco-brachialis, and occasionally a fourth muscle, Pronator radii teres. The external surface gives attachment to the Deltoid about two-fifths or one-half the way down the bone, and below this to the

external part of the *Brachialis anticus*. **The internal surface** gives attachment to the *Coraco-brachialis* opposite the *Deltoid*, and below this to the internal part of the *Brachialis anticus*.

The posterior surface has the two lower heads of the *Triceps* and the musculo-spiral groove separating them. The lower part of the bone articulates with the radius and ulna; the part which articulates with the radius is called the radial head or capitellum and is on a higher level than the part which articulates with the ulna which is called the trochlear surface. These two articulating surfaces are separated by a ridge. Above the radial head on the external surface is the radial depression for the head of the radius to fit into when the forearm is flexed; above the trochlear surface on the internal surface is the coronoid depression for the coronoid process of the ulna; above the trochlear surface on the posterior surface is the olecranon depression for the olecranon process of the ulna.

The internal condyle is more prominent than the external one, and is on a lower level. It gives attachment to the *Pronator radii teres*, the common tendon for some of the flexors of the forearm, and the internal lateral ligament. The external condyle is less prominent than the internal one and gives attachment to the common tendon for the attachment of some of the extensors of the forearm as well as the *Supinator longus* and external lateral ligament.

OSSIFICATION.—The ossification is from seven centers, occasionally eight. One for the shaft appears about the eighth week of intrauterine life. The one for the head the first year, one for the great tuberosity the third year; occasionally one for the lesser tuberosity. These three coalesce at the 17th year and join the shaft about the 20th year. At the distal extremity there are four centers of ossification; one for the capitellum appears at the 3rd year; one for the internal condyle at the 5th year; one for the trochlear at the 10th year; one for the external condyle at the 14th year.

The nucleus of the internal condyle joins the shaft in the 18th year, while the other three nuclei coalesce and join the shaft the 17th year.

ARTICULATION.—It articulates with the scapula, radius, and ulna. Its articulation with the scapula makes the shoulder-joint, a description of which is given in Lesson IX; and its articulation with the radius and ulna makes the elbow-joint.

Elbow-joint.—(Plates XXXVIII-XXXIX.)—This is a movable joint (diarthrosis) and belongs to the sub-class ginglymus (hinge-joint.) The part between the trochlear surface of the humerus and the great sigmoid cavity of the ulna is a ginglymus joint, but the part between the capitellum of the humerus and the head of the radius is an arthrodial joint (gliding.) The part between the lesser cavity of the ulna and the head of the radius is a trochoides. The **anterior ligament** is continuous with the internal and external lateral ligaments covering the joint in front and being itself covered by the *Brachialis anticus*; above, it is attached to the humerus above the coronoid and radial fossæ and in front of the internal condyle; below, it is attached to the anterior surface of the coronoid process of the ulna and the orbicular ligament and the neck of the radius.

The **internal lateral ligament** is continuous with the anterior and posterior ligaments; it is triangular in shape, with the apex above, attached to the internal condyle of the humerus; the anterior angle below is attached to the inner edge of the coronoid process. Its posterior angle below is attached to the inner edge of the olecranon process. There are fibers running from the apex to each inferior angle, also fibers connecting the inferior angles. The Flexor sublimus digitorum is attached to this ligament.

The **posterior ligament** is continuous with the two lateral ligaments; it is attached above to the margin of the olecranon fossa and below to the olecranon process and orbicular ligament.

The **external lateral ligament** is attached above to the depression below the external condyle of the humerus; below, it is attached to the orbicular ligament, head of the radius and the outer side of the ulna; there are two muscles attached to this ligament, the Extensor carpi radialis brevis and Supinator brevis. These four ligaments make a capsular ligament. Synovial membrane lines that portion of the ligaments and bones which make the joint and sends a part into the superior radio-ulnar articulation.

The ligamentous muscles of the elbow-joint are the Biceps, Triceps, Brachialis anticus and all the muscles in the forearm except, the Flexor profundus digitorum, Flexor longus pollicis, Pronator quadratus and Extensor ossis metacarpi pollicis, Extensor brevis pollicis, Extensor longus pollicis and Extensor indicis.

Nerve supply.—Musculo-spiral, musculo-cutaneous, median and ulnar nerves.

Blood supply.—Anterior and posterior ulnar recurrent, radial recurrent, interosseous recurrent, anastomatica magna, superior profunda and inferior profunda.

LESSON XIV.

ARTERIES.

Axillary artery.—The subclavian artery passes under the clavicle and over the first rib, from the lower surface of which it is called the Axillary artery until it leaves the axillary space at the lower border of the tendon of the Teres major, then it takes the name Brachial artery. This artery is crossed by the Pectoralis minor muscle which divides the artery into three parts; the part above it is called the first part, the part behind it is called the second part and the part below it is called the third part (Plate XVI).

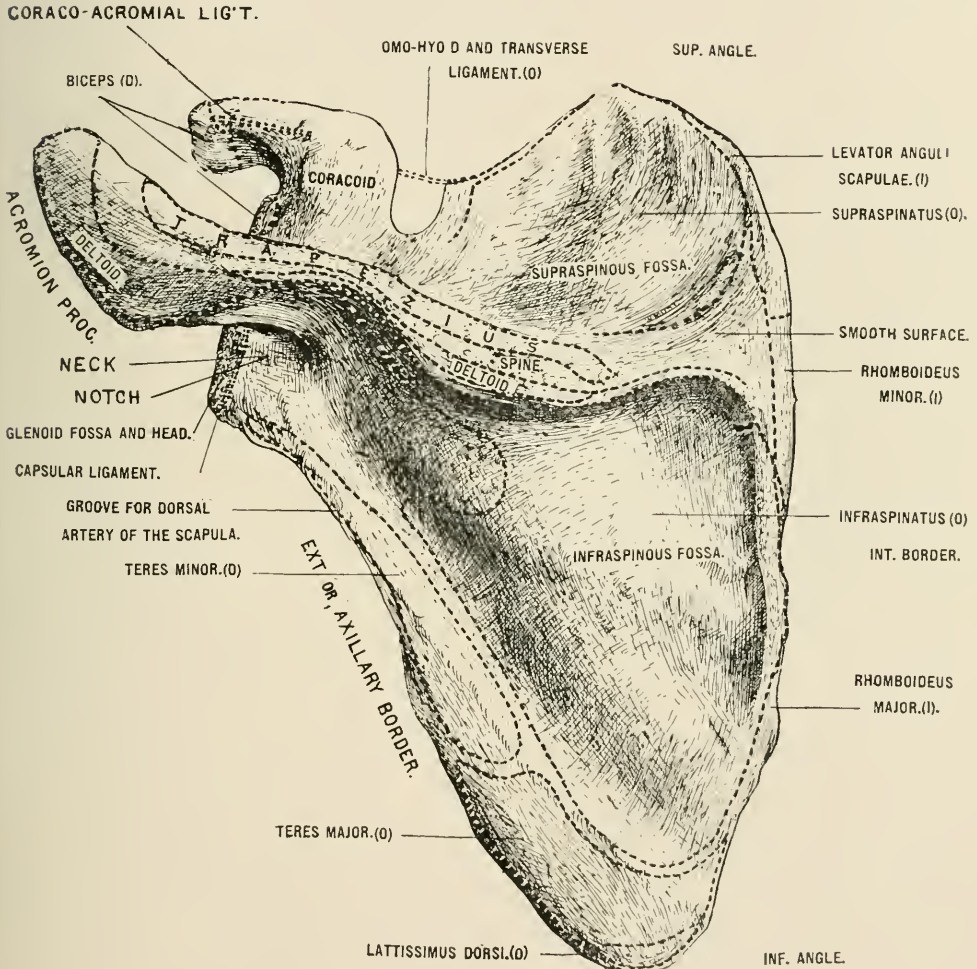
Branches.—This artery has seven branches, (Plate XVII) two from the first portion, the superior thoracic and the acromial thoracic; two from the second portion, the alar thoracic and the long thoracic or external mammary, and three from the third portion, the subscapular, anterior circumflex, and posterior circumflex.

The **superior thoracic** arises so close to the upper border of the axillary artery that it is sometimes given as a branch of the subclavian. It may come from the acromial thoracic axis. It is between the Pectoralis major and minor,

along the upper border of the latter, supplying both these muscles, the Serratus magnus and the chest wall. It anastomoses with the internal mammary, intercostal arteries and the long thoracic. It helps to supply the sterno-clavicular joint.

The **aeromial thoracic** arises just above the Pectoralis minor from the front

PLATE XX

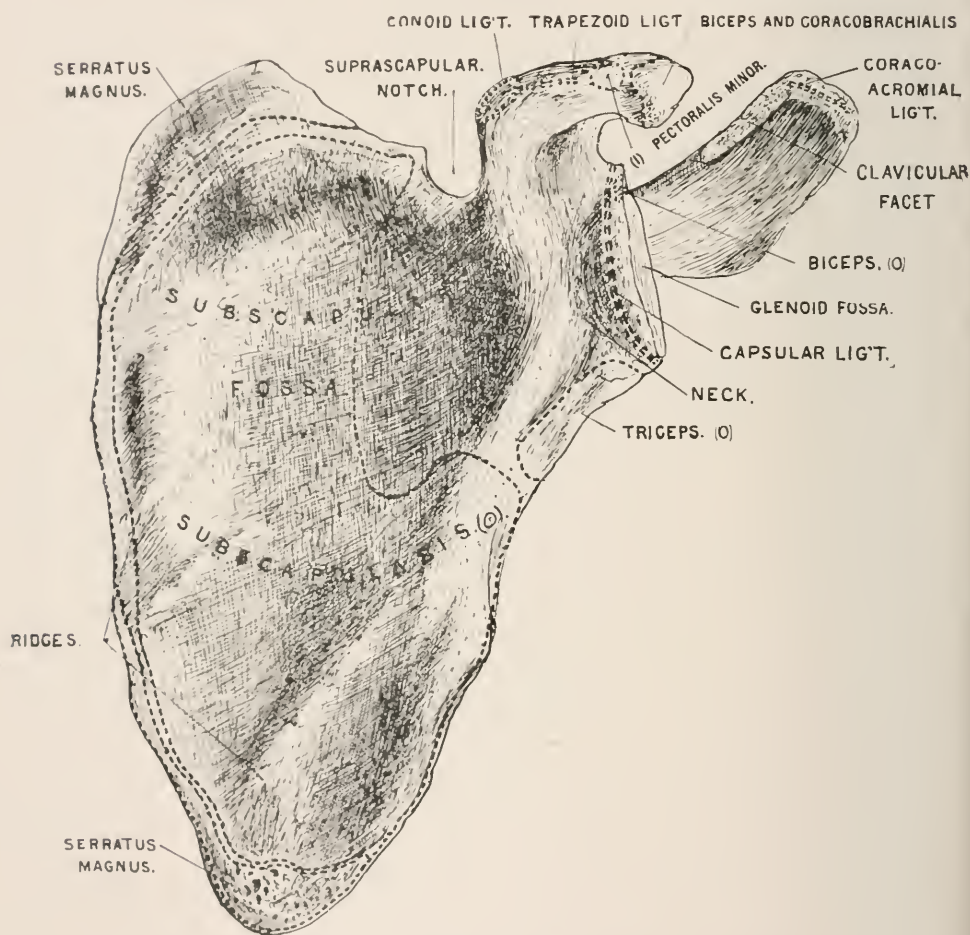


THE LEFT SCAPULA—POSTERIOR SURFACE, OR DORSUM

part of the artery. It has an axis and gives off three branches. (1) humeral or descending branch which passes down between the Pectoralis major and Deltoid with the cephalic vein, supplying both these muscles; it anastomoses with the anterior and posterior circumflex arteries. (2) the aeromial branch which supplies the Deltoid muscle and the acromio-clavicular joint, anastomosing with the anterior and posterior circumflex and suprascapular arteries

making the acromial rete. If we substitute in this rete or net-work of arteries, this branch for the subscapular artery we will have the blood supply to the shoulder-joint. (3) The thoracic branches supply the Pectoral muscles and the Serratus magnus, and anastomoses with the intercostal arteries both from the aorta and the internal mammary. There are two or three of these branches. (4) A clavicular branch may pass to the Subclavius muscle.

PLATE XXI



THE LEFT SCAPULA—ANTERIOR SURFACE, OR VENTER

The alar thoracic is not a constant branch; it supplies the glands and half of the axillary space. When it is absent its place is filled by a branch from one of the other thoracic arteries.

The anterior or long thoracic, or external mammary passes along the lower border of the Pectoralis minor muscle to about the sixth intercostal space, supplying the Pectoral and Serratus magnus muscles, and the mammary gland. It anastomoses with the intercostal, internal mammary, and superior thoracic

arteries. There is often an accessory external mammary which is behind the main branch.

The **anterior circumflex** arises from the outer side of the axillary artery, passing between the Coraco-brachialis and the short head of the Biceps around the anatomical neck of the humerus to the undersurface of the Deltoid, which it supplies. A branch from this artery passes up the bicipital groove, with the long head of the Biceps, to supply the shoulder-joint. It anastomoses with the posterior circumflex and acromial thoracic. An occasional cutaneous branch is often given to the floor of the axilla.

The **posterior circumflex** comes from the posterior part of the artery, below the subscapular. It passes through the quadrilateral space which is bounded above by the Teres minor, below by the Teres major, on the inner side by the long head of the Triceps and on the other side by the humerus; its veins and the circumflex nerve go with it. It anastomoses with the anterior circumflex, subscapular, suprascapular, acromial thoracic, and a branch from the superior profunda. This artery may be a branch from the brachial, superior profunda, or may come from a common trunk with the subscapular. It goes to the Deltoid, long head of the Triceps, Teres minor, shoulder-joint and head of the humerus.

The **subscapular artery** runs along the lower border of the Subscapularis muscle with the subscapular nerve to the inferior angle of the scapula, where it anastomoses with the posterior scapular and a terminal branch of the transversalis colli; it also anastomoses with the intercostal and long thoracic arteries. It gives branches to the glands and areolar tissue of the axilla, to the Teres major, Latissimus dorsi. Subscapular which passes through the triangular space bounded above and internally by the Subscapularis, below by the Teres major, and externally by the long head of the Triceps. It anastomoses with the suprascapular and posterior scapular arteries. It gives branches to the Subscapularis and Infraspinatus muscles.

RELATIONS.—First Portion of Axillary Artery.

IN FRONT.—(1) Pectoralis major, (2) Costo-coracoid membrane, (3) External anterior thoracic nerve, (4) Acromio-thoracic vein, (5) Cephalic vein.

BEHIND.—(1) First intercostal space, (2) First intercostal muscle, (3) Second and third serrations of Serratus magnus, (4) Posterior thoracic nerve, and (5) Internal anterior thoracic nerve.

OUTER SIDE.—Brachial plexus.

INNER SIDE.—Axillary vein.

Second Portion of Axillary Artery.

IN FRONT.—(1) Pectoralis major, (2) Pectoralis minor.

BEHIND.—(1) Subscapularis, (2) Posterior cord of plexus.

OUTER SIDE.—Outer cord of plexus.

INNER SIDE.—(1) Axillary vein, (2) Inner cord of plexus, and (3) Internal anterior thoracic nerve.

Third Portion of Axillary Artery.

IN FRONT.—(1) Integument and fascia, (2) Pectoralis major, (3) Inner head of median nerve, and (4) Internal cutaneous nerve.

BEHIND.—(1) Subscapularis, (2) Tendon of Latissimus dorsi, (3) Tendon of Teres major, (4) Musculo-spiral nerve, and (5) Circumflex nerve.

OUTER SIDE.—(1) Coraco-brachialis, (2) Median nerve, (3) Musculo-cutaneous nerve.

INNER SIDE.—(1) Ulna nerve, (2) Lesser internal cutaneous nerve, and (3) Axillary veins.

LESSON XV.

Brachial artery.—Plates XVI-XVII.)—The brachial artery extends from the lower border of the Teres major, above which it is called Axillary, to about one and a half inches below the elbow where it divides into the Radial and Ulnar. It passes along the inner and fore part of the arm, being accompanied by venæ comites and is comparatively superficial. It has the following relations:

IN FRONT.—(1) Integument and fascia, (2) Bicipital fascia, (3) Median basilic vein, (4) Median nerve, and (5) Overlapped by Coraco-brachialis and Biceps.

BEHIND.—(1) Triceps, (2) Musculo-spiral nerve, (3) Superior profunda artery, (4) Coraco-brachialis (insertion), and (5) Brachialis anticus.

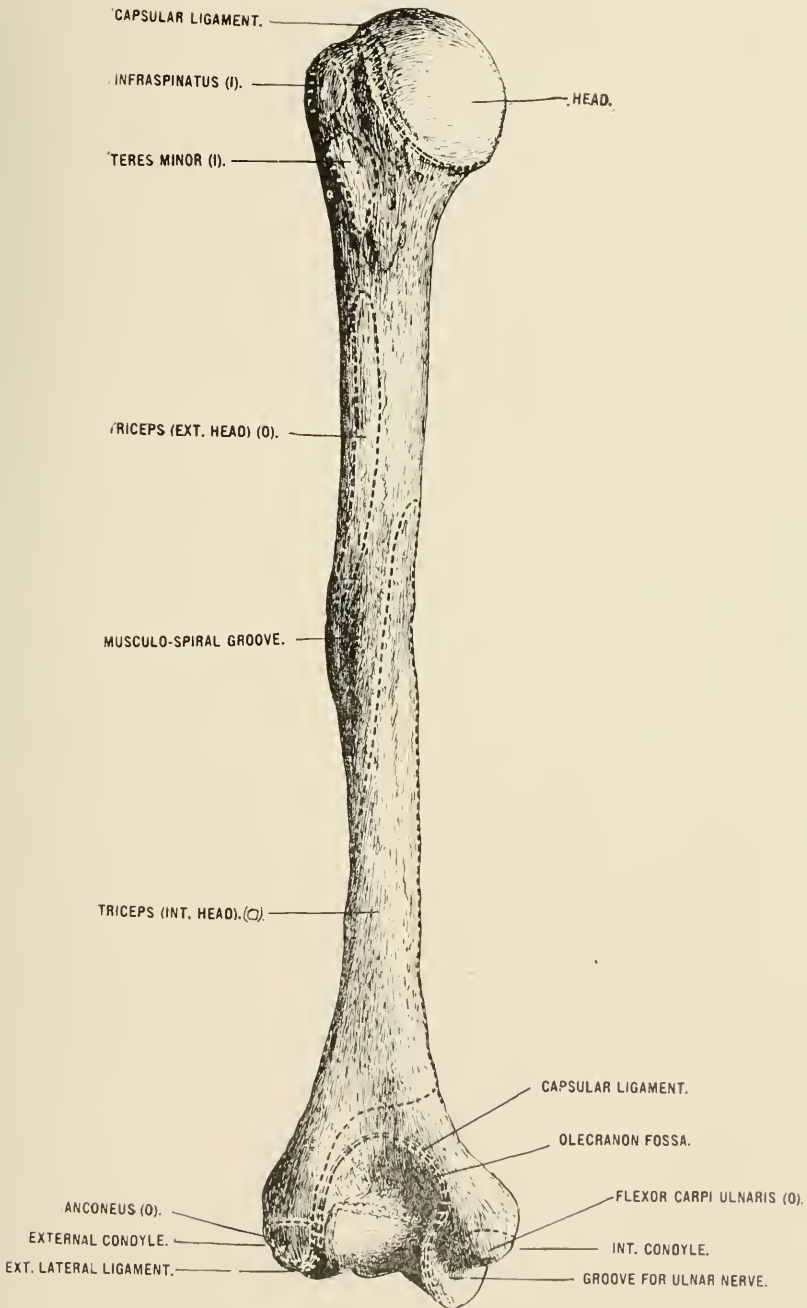
OUTER SIDE.—(1) Vena comes, (2) Median nerve (above), (3) Coraco-brachialis, and (4) Biceps.

INNER SIDE.—(1) Vena comes, (2) Internal cutaneous nerve, (3) Ulnar nerve, (4) Median nerve (below), and (5) Basilic vein (upper half).

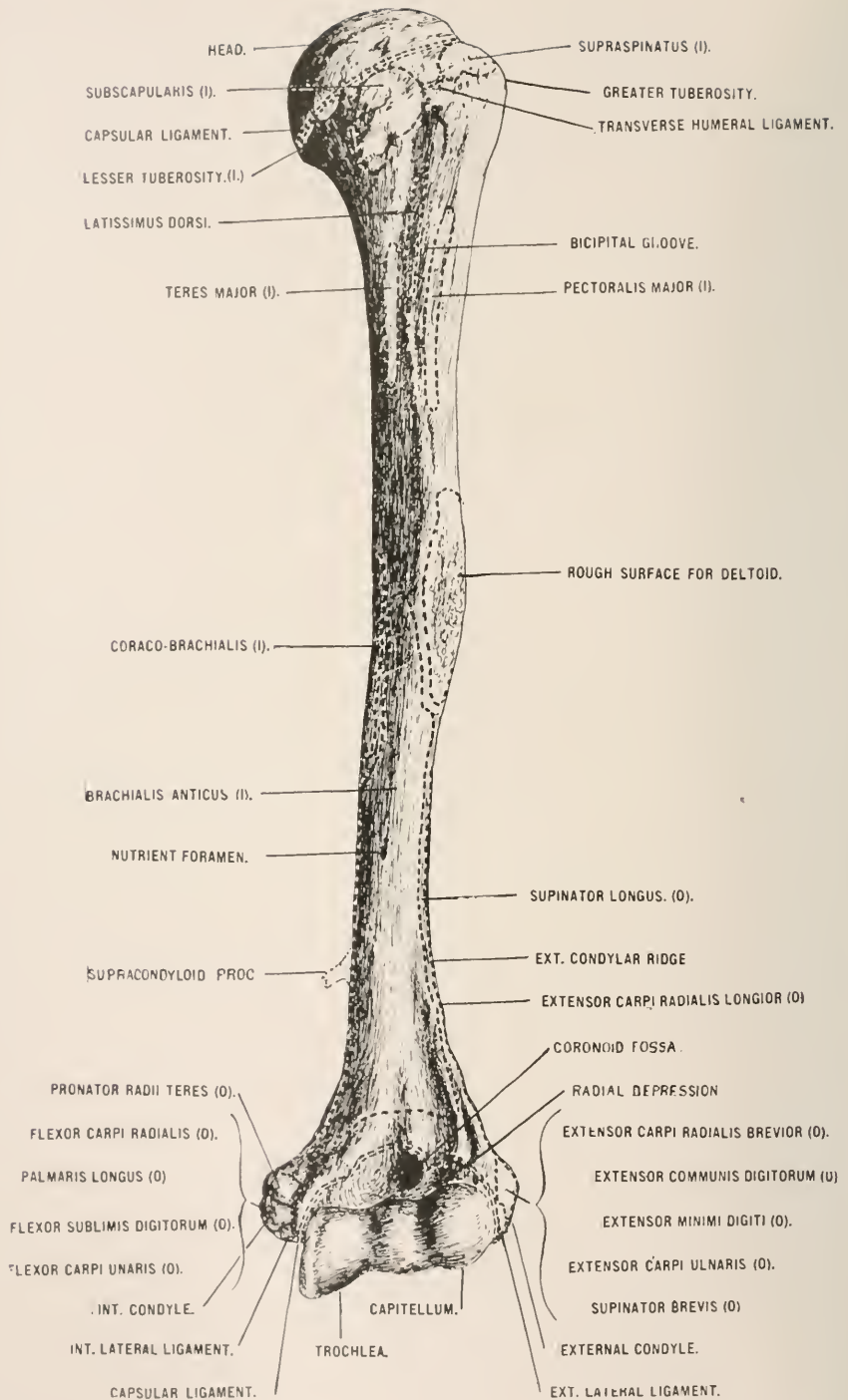
Its branches are the superior profunda, inferior profunda, nutrient, muscular, anastomotica magna, and occasionally the vasa aberrantia.

The **superior profunda**, the largest branch, arises from the inner and back part of the artery opposite the lower border of the Teres major. It winds backward and outward with the musculo-spiral nerve in the musculo-spiral groove. It gives off an anterior branch which pierces the external intermuscular septum to anastomose with the radial recurrent. It continues behind the external intermuscular septum with a branch of the musculo-spiral nerve to the Anconeus, where it anastomoses with the anastomotica magna and interosseous recurrent. It supplies the Triceps and Anconeus. The anterior branch which it gives off passes to the front of the elbow in the groove between the Supinator longus and the Brachialis anticus to the front of the external condyle. It gives branches to the Deltoid, Brachialis anticus, and Triceps, and a branch to anastomose with the circumflex artery. The artery continues as the posterior branch.

The **inferior profunda** may come from the superior profunda, but generally comes from the brachial opposite the insertion of the Coraco-brachialis. It accompanies the ulnar nerve to the back of the internal condyle, having pierced the internal intermuscular septum from before backward. It anastomoses with the anastomotica magna and posterior ulnar recurrent. Its anterior branch extends to the front of the internal condyle to anastomose with the anastomotica magna and anterior ulnar recurrent.



THE LEFT HUMERUS—POSTERIOR VIEW.



THE LEFT HUMERUS—ANTERIOR VIEW.

The **nutrient artery** comes from the brachial about the middle of the forearm; it pierces the tendon of the Coraco-brachialis to enter the nutrient canal which is below the insertion of the Coraco-brachialis. It is directed towards the elbow (page 19, Lesson 1.) A branch from the musculo-cutaneous nerve enters the bone with this artery. The artery may be a branch of the superior profunda.

The **muscular branches** are three or four in number and arise from the outer side of the artery and supply the Biceps, Coraco-brachialis, and Brachialis anticus. The same muscles are supplied by the musculo-cutaneous nerve.

The **anastomotica magna** arises two inches above the elbow-joint; passing inward over the Brachialis anticus to pierce the internal intermuscular septum to pass to the back of the internal and external condyles. It anastomoses in front of the internal condyle with a branch from the inferior profunda and anterior ulnar recurrent. It anastomoses behind the internal condyle with the posterior branch of the inferior profunda and the posterior ulnar recurrent. It anastomoses behind the external condyle with the posterior branch of the superior profunda and the interosseous recurrent.

The **vasa aberrantia** are collateral branches which connect the brachial or axillary artery with the arteries of the forearm, generally with the radial.

Forearm.—There are twenty muscles in the forearm, eight in the anterior (radio-ulnar) region arranged in four layers; in the first layer there are four—(Plate XXIX)—The Pronator radii teres, Flexor carpi radialis, Palmaris longus, and Flexor carpi ulnaris. The first three of these are supplied by the median nerve, which comes from the outer and inner cords of the brachial plexus. The Flexor carpi ulnaris is supplied by the ulnar nerve, which comes from the inner cord. (Plate VI.) In the second layer there is one muscle, the Flexor sublimis digitorum. (Plate XXX.) It is supplied by the median nerve. In the third layer there are two muscles. (Plate XXXI.) Flexor longus pollicis and the Flexor profundus digitorum. The first is supplied by the anterior interosseous, which is a branch of the median; the second one by the anterior interosseous and the ulnar. In the fourth layer there is one muscle, the Pronator quadratus, which is supplied by the anterior interosseous nerve.

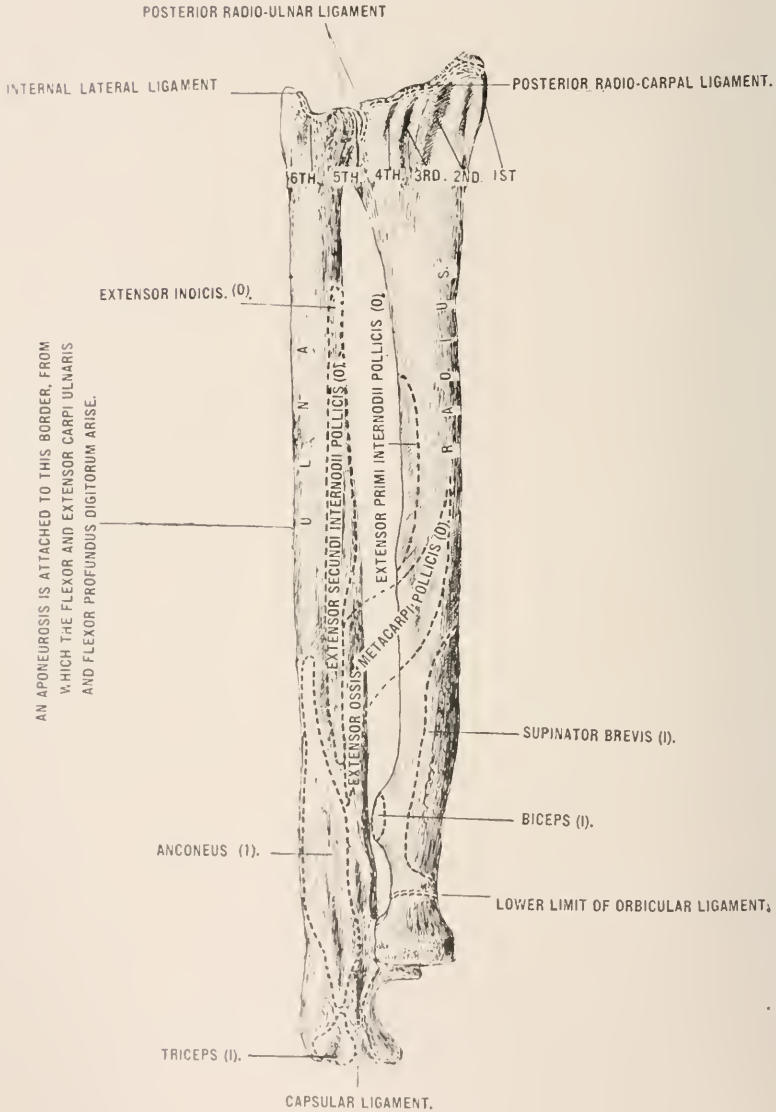
In the **radial region** there are three muscles (Plate XXXII) Brachio-radialis (Supinator longus,) Extensor carpi radialis longior, and the Extensor carpi radialis brevior. The first two are supplied by the musculo-spiral nerve; the last one by the posterior interosseous nerve which is a branch of the musculo-spiral nerve.

In the **posterior radio-ulnar region** there are nine muscles, (Plate XXXII,) four in the superficial layer and five in the deep layer. The four in the superficial layer are the Extensor communis digitorum, Extensor minimi digiti, Extensor carpi ulnaris, and Anconeus. The first three are supplied by the posterior interosseous nerve; the Anconeus by the musculo-spiral nerve. (Plate XXXIII.) The five muscles in the deep layer are the Supinator brevis, Extensor ossis metacarpi pollicis, Extensor brevis pollicis, Extensor longus pollicis, and the Extensor indicis; they are all supplied by the posterior interosseous nerve.

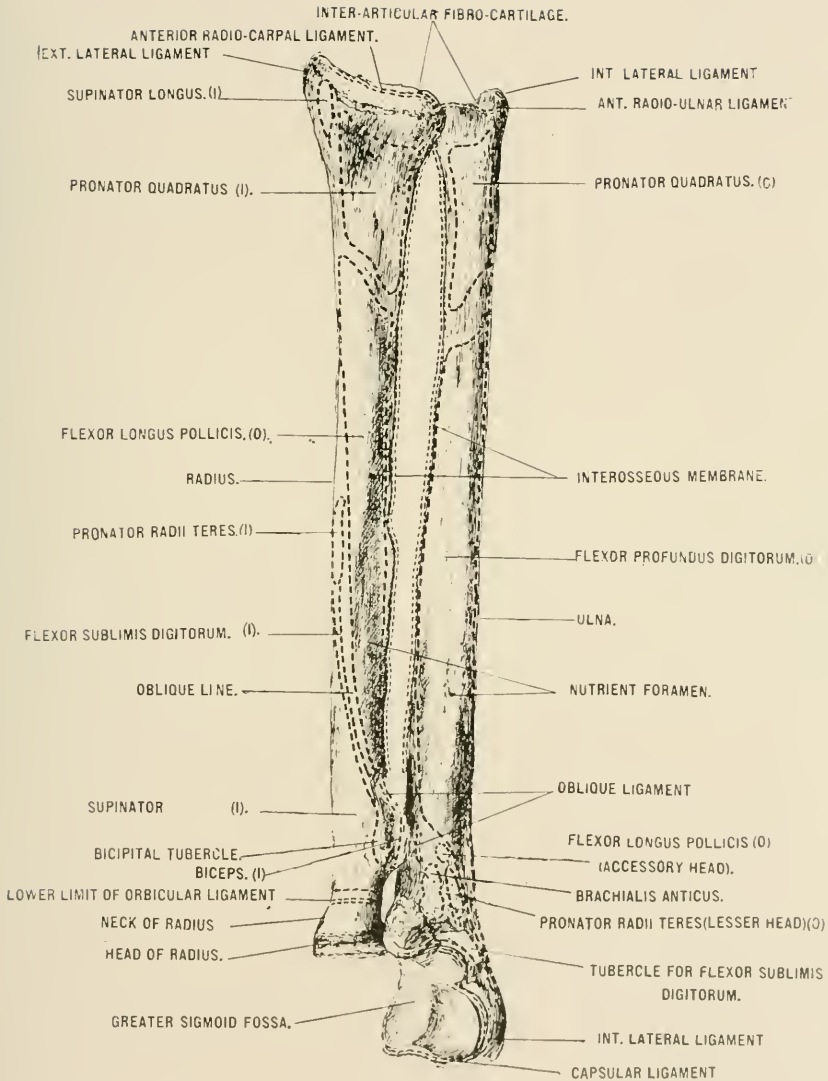
The **bones of the forearm** are the radius and ulna; the radius has nine mus-

PLATE XXIV.

- GROOVES FOR - 1ST. - EXTENSOR OSSIS METACARPI POLLICIS AND EXTENSOR PRIMI INTERNODII POLLICIS.
 2ND. - EXTENSOR CARPI RADIALIS LONGIOR AND BREVIOR.
 3RD. - EXTENSOR SECUNDI INTERNODII POLLICIS
 4TH. - EXTENSOR COMMUNIS DIGITORUM AND EXTENSOR INDICIS.
 5TH. - EXTENSOR MINIMI DIGITI.
 6TH. - EXTENSOR CARPI ULNARIS.



LEFT RADIUS AND ULNA—POSTERIOR VIEW.



LEFT RADIUS AND ULNA—ANTERIOR VIEW.

cles attached to it and the ulna fourteen. Although there are twenty-three muscles attached to these two bones, yet there are but twenty muscles in the forearm, the Triceps, Biceps, and Brachialis anticus are in the arm (between the shoulder and elbow.) The elbow-joint is described in Lesson XIII.

LESSON XVI.

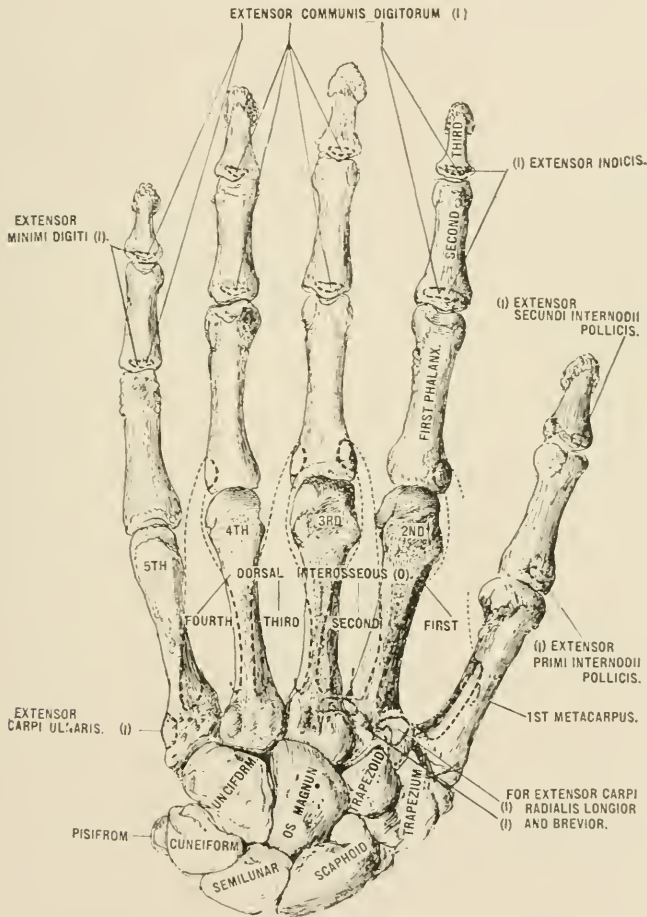
The **Radius** (Plates XXIV-XXV) is the shorter of the two bones of the forearm. Its distal extremity is larger than that of the ulna, while its proximal extremity is smaller than that of the ulna. These two bones lie parallel. The proximal extremity has a head, neck, and tuberosity; the circumference of the head is concave. Its inner portion which articulates with the lesser sigmoid cavity of the ulna is broader than the remaining portion which articulates in the orbicular ligament. The upper surface of the head is also concave for the articulation of the caputellum or radial head of the humerus; it is covered with cartilage in the recent state. The neck is the constricted part below the head; the proximal part of the neck is surrounded by the distal part of the orbicular ligament and distally it gives attachment to the Supinator brevis externally. The bicipital tuberosity is distally from the neck at the antero-internal aspect of the bone. It has a rough posterior portion for the insertion of the tendon of the Biceps, and a smooth anterior portion for a bursa which is between the tendon and the bone. The shaft is triangular on cross section and has three borders and three surfaces. The **anterior border** extends from the bicipital tuberosity distally to the outer aspect of the bone, then to the anterior border of the styloid process. The proximal one-third of this border is the oblique line of the radius; it separates the Supinator brevis from the Flexor longus pollicis, and gives attachment to the third head of the Flexor sublimis digitorum; it separates the anterior surface from the external surface. The **inner or interosseous border**, extends from the posterior part of the bicipital tuberosity proximally to the sigmoid cavity of the radius; its distal part divides into an anterior and posterior portion and has the interosseous membrane attached to most of its extent; it separates the anterior from the posterior surface. The **posterior border** which is well marked in the middle one-third, extends from the back part of the neck of the radius to the middle tubercle on the posterior aspect of the distal extremity; it separates the posterior from the external surface. The **anterior surface** is concave at the proximal extremity and smooth at the distal extremity.

The proximal three-fourth gives attachment to the Flexor longus pollicis, and the distal one-fourth to the Pronator quadratus. Where the proximal one-third joins the middle one-third, is the nutrient foramen which is directed towards the elbow. The nutrient artery is a branch of the anterior interosseous. The **posterior surface** is convex from the proximal to the distal extremity; it is covered by the Supinator brevis, Extensor ossis metacarpi pollicis, Extensor brevis pollicis, and the distal one-third is covered by tendons. The oblique line marks the proximal limit of the Extensor ossis metacarpi pollicis. The **exter-**

nal surface is convex from the proximal to the distal extremity; it has attached to it the Supinator brevis, and about the center the Pronator radii teres, and distally it is covered by the Extensor carpi radialis longior and Extensor carpi radialis brevior which are crossed by the Extensor ossis metacarpi pollicis and Extensor brevis pollicis.

The **lower extremity** is quadilateral. The lower surface which is concave, articulates with the scaphoid and semilunar. The part which articulates with

PLATE XXVI



BONES OF LEFT HAND—POSTERIOR VIEW

the scaphoid is triangular, while that which articulates with the semilunar is quadilateral. These parts are separated by a ridge. The inner surface is concave and articulates with the head of the ulna. The interarticular fibro-cartilage is attached to the border between the sigmoid cavity and the semilunar surfaces.

The **perimeter** is triangular, having an anterior, external, and posterior

ARTICULATION.—It articulates with four bones, the humerus, ulna, scap-hoid and semilunar.

MUSCLES.—It has nine muscles attached, the Biceps, third head of the Flexor sublimis digitorum, Supinator brevis, Flexor longus pollicis, Pronator quadratus, Pronator radii teres, Supinator longus, Extensor ossis metacarpi pollicis and Extensor brevis pollicis.

BLOOD SUPPLY.—The nutrient artery is derived from the anterior inter-osseous trunk; it enters the shaft near the middle of the anterior surface, and runs towards the proximal end of the bone. The head of the bone is supplied by the radial recurrent and interosseous recurrent arteries. The lower end is supplied by the anterior and posterior interosseous arteries and numerous twigs from carpal arches.

LESSON XVII

The **Ulna** (Plates XXIV-XXV.) is the longer of the two bones of the forearm; its proximal extremity is larger than that of the radius, while its distal extremity is smaller than that of the radius. On cross section it is triangular, but its distal part is more circular. It has a proximal and distal extremity and a diaphysis. The proximal extremity has the olecranon process and the greater and lesser sigmoid cavities. The **olecranon** (meaning head of elbow) is concave from above down, and convex transversely on its articular surface which is covered with cartilage in the recent state. Its margins give attachment to the capsular ligament of the elbow. This surface makes the greater part of the greater sigmoid cavity. On its inner surface is a tubercle for the ulnar origin of the Flexor carpi ulnaris. The internal lateral ligament has an attachment in front of the tubercle. The other surface gives attachment to part of the Anconeus.

The extremity of the process fits into the olecranon fossa of the humerus when the arm is extended. Its upper surface has a concave impression for the tendon of the Triceps and the anterior margin for the posterior ligament. The posterior surface is covered by a bursa. The coronoid (like a crown) makes the lower part of the greater sigmoid cavity and the upper part of the bone.

Its upper surface is covered with cartilage in the recent state. When the arm is flexed it fits in the coronoid impression of the humerus. On its outer surface is the lesser sigmoid cavity for the head of the radius. The orbicular ligament is attached to the margin of the lesser sigmoid cavity.

On its inferior surface is an impression for the insertion of the Brachialis anticus. Where it joins the shaft of the ulna is the tubercle for the attachment of the oblique ligament. On the inner surface is the attachment of the internal ligament, one attachment for the Flexor sublimis digitorum; behind this is a depression for the attachment of the Flexor profundus digitorum, and distally from this one for the Pronator radii teres, and occasionally one attachment for the Flexor longus pollicis.

The greater and lesser sigmoid cavities have been described with these two processes. The **diaphysis** has three borders and three surfaces. The **anterior border** extends from the inner angle of the coronoid process to the front of the styloid process; for most of the extent it is smooth and rounded. It separates the anterior and internal surfaces and gives attachment to the Flexor profundus

digitorum proximally, and the Pronator quadratus distally. The **posterior border** commences at the apex of a triangular subcutaneous surface at the back of the olecranon and continues to the back part of the styloid process. It is well marked in the proximal three-fourths and gives attachment to the common aponeurosis which has three muscles attached to it, viz., the Extensor carpi ulnaris, Flexor carpi ulnaris and Flexor profundus digitorum. This border separates the internal and posterior surfaces. The **outer or interosseous border**, is divided above, extending to the anterior and posterior extremities of the sigmoid cavity: embracing the triangular depression (the bicapital hollow). In the front part of this impression lodges the tubercle and tendon of the Biceps, when the arm is pronated, and the back part gives attachment to the Supinator brevis. It separates the anterior and posterior surfaces. To its distal four-fifths is attached the interosseous membrane. The **anterior surface** is grooved in the proximal three-fourths of its extent, which is broader than the distal portion, and gives attachment to the Flexor profundus digitorum. Its distal one-fourth gives attachment to the Pronator quadratus. The pronator ridge, or oblique line, is directed distally and inward at the proximal limit of the Pronator quadratus.

The **nutrient foramen** is on this surface at the junction of the proximal one-third with the middle one-third, and is directed towards the elbow. The nutrient artery is a branch of the anterior interosseous.

The **internal surface** is broad and concave proximally, narrow and convex distally. The proximal three-fourths gives attachment to the Flexor profundus digitorum, whereas the distal one-fourth is subcutaneous. The **posterior surface** is broad and concave proximally, narrow and convex in the middle, narrow, smooth, and round distally. Its oblique line runs from the posterior extremity of the lesser cavity distally to the posterior border. The first part of this line gives attachment to the Supinator brevis. The triangular surface between this line and the elbow receives the insertion of the Anconeus. The outer portion of this surface gives attachment to the Supinator brevis, Extensor ossis metacarpi pollicis, Extensor longus pollicis, and Extensor indicis. The inner portion is smooth, being covered with the Extensor carpi ulnaris. A perpendicular ridge separates these two portions of this surface.

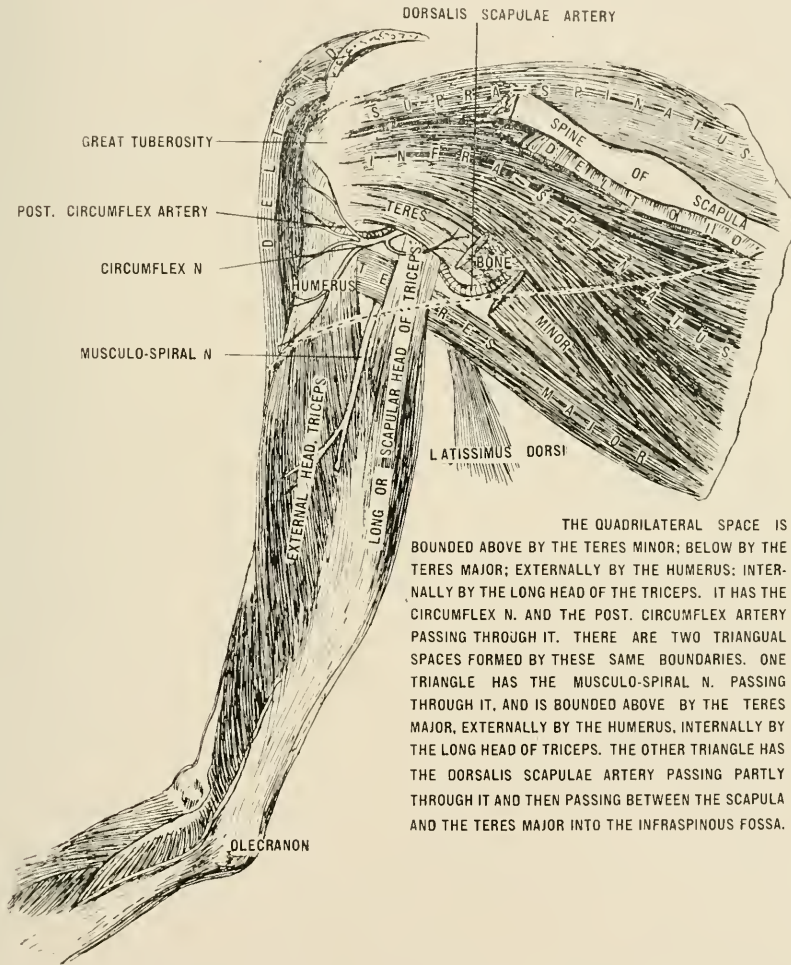
The **lower extremity** is small and consists of two parts, a head and styloid process. On the articular surface they are separated by a groove which receives the apex of the interarticular fibro-cartilage, thus separating the ulna from the wrist-joint. The margin of the head is received in the sigmoid cavity of the radius and the styloid process is a continuation of the posterior border projecting from the inner and back part of the bone. Its apex gives attachment to the internal lateral ligament; its posterior surface is grooved for the Extensor minimi digiti.

OSSIFICATION.—From three centers, one for the shaft about the eighth week, one for the distal extremity about the fourth year which joins the shaft the eighteenth or twentieth year, and one for the proximal extremity the tenth year which joins the shaft the sixteenth or seventeenth year.

ARTICULATION.—It articulates with the humerus and radius.

MUSCLES.—It has fourteen muscles attached. Triceps, Anconeus, Flexor carpi ulnaris, Brachialis anticus, Supinator brevis, Flexor sublimis digitorum, Flexor profundus digitorum, Pronator quadratus, Extensor carpi ulnaris, Pronator radii teres, Extensor ossis metacarpi pollicis, Extensor longus pollicis, Extensor indicis, and Flexor longus pollicis.

PLATE XXVIII



SHOWING THE QUADRILATERAL SPACE AND STRUCTURES PASSING THROUGH IT

BLOOD SUPPLY.—The nutrient vessel enters the shaft near the middle of the anterior surface; it is derived from the anterior interosseous trunk, and is directed towards the proximal end. The upper extremity receives branches from the anterior and posterior ulnar recurrent and from the interosseous recurrent. The lower end receives twigs from the anterior and posterior interosseous arteries.

LESSON XVIII.

The **wrist-joint** is a condyloid joint (Plate XL) having all movements except axial rotation. It is formed by the lower head of the radius and the interarticular fibro-cartilage proximally and the scaphoid, semilunar, and cuneiform bones distally. The ulna does not go into the joint, being separated by the interarticular fibro-cartilage from the bones of the wrist.

The ligaments of this joint are the anterior, posterior, internal lateral, and external lateral which make a capsular ligament. The **anterior ligament** extends from the anterior surface of the lower border of the ulna to the front of the interarticular fibro-cartilage, also from the anterior surface of the lower border of the radius and its styloid process, to the palmar surface of the scaphoid, semilunar, and cuneiform bones distally, some fibers continuing to the os magnum and the unciform bones. There are some superficial fibers passing from the styloid process of the ulna to the semilunar and cuneiform. This ligament is pierced by small vessels. The **posterior ligament** is weaker than the anterior one; it extends from the posterior surface of the lower part of the radius and the triangular interarticular fibro-cartilage to the posterior surface of the scaphoid, semilunar and cuneiform bones. The **internal lateral ligament** extends from the tip of the styloid process of the ulna to the inner surface of the cuneiform, by one of its divisions, and to the pisiform and annular ligament by the other. The **external lateral ligament** extends from the styloid process of the radius to the outer side of the scaphoid, some fibers continuing to the trapezium and annular ligament.

A synovial membrane which is very lax and does not communicate with the joint above and below, lines the ligaments of this joint. (Plate XLII.)

The **nerve supply** is the ulnar, anterior and posterior interosseous.

The **blood supply** is the anterior and posterior interosseous, anterior and posterior carpal arches, and recurrent branches from the deep palmar arch.

The **superior radio-ulnar articulation** is a trochoides, and is formed by the head of the radius and the lesser sigmoid cavity of the ulna. Its only ligament is the orbicular, which surrounds the head of the radius. It is connected to the anterior and posterior borders of the lesser sigmoid cavity, and with it makes a complete ring. Its lower circumference is less than that of the upper, thus holding the head of the radius in position. It blends with all the ligaments of the elbow, except the internal; the synovial membrane continues with that of the elbow.

The **middle radio-ulnar articulation** has two ligaments; first, the oblique or round ligament which passes distally and outward from the base of the coronoid process to the bicipital tuberosity of the radius. This ligament is often absent. Second, the interosseous membrane, passing between the two adjacent borders of the radius and ulna; its fibers pass distally and inward. It commences beyond the bicipital tuberosity of the radius and extends almost to the distal extremity of the two bones. It affords attachment to the muscles. The anterior interosseous artery passes to the back of the forearm, between the radius and ulna beyond this membrane. The posterior interosseous vessels pass

to the back of the forearm between the radius and ulna above this membrane.

The **inferior radio-ulnar articulation** is a trochoides, and is formed by the head of the ulna and the sigmoid cavity of the radius and fibro-cartilage. Its ligaments are the anterior and posterior radio-ulnar which make the capsular ligament. The anterior radio-ulnar ligament passes from the front border of the sigmoid cavity of the radius to the anterior surface of the head of the ulna. The **posterior one** is a similar ligament on the posterior surface. The **triangular interarticular fibro-cartilage** is at the lower end of the ulna, between the styloid process and the radius. Its perimeter is attached to the ligaments of the wrist; it is attached by its apex to the depression between the head and styloid process of the ulna, by its base to the lower end of the radius. Sometimes it is perforated, in such a case the synovial membrane communicates with that of the wrist.

The **blood supply** is the anterior interosseous and anterior carpal arch.

The **nerve supply** is the anterior and posterior interosseous. Synovial membrane, the *membrana sacciformis*, lines the adjacent surfaces of the ulna and the interarticular fibro-cartilage, and the ulna and the radius. As stated before, it sometimes communicates with the wrist-joint.

Brachialis anticus.—DESCRIPTION.—(Plate XVI.)—This is a broad muscle which covers the elbow-joint and the lower half of the front of the humerus. It is somewhat compressed from before backward and is broader in the middle than at either extremity. Its fibers converge to a thick tendon. The outer border of the muscle is in relation with the musculo-spiral nerve and radial recurrent artery.

ORIGIN.—(1) Lower half of outer and inner surfaces of shaft of humerus; (2) intermuscular septa; (3) commences above at insertion of Deltoid and extends below to within one inch of margin of articular surface. (Plate XXIII.)

INSERTION.—Into a rough depression on the anterior surface of the coronoid process of the ulna, being received into an interval between two fleshy slips of the *Flexor profundus digitorum*. (Plate XXV.)

ACTION.—Flexor of forearm.

NERVE SUPPLY.—Fifth and sixth cervical through the musculo-cutaneous and musculo-spiral.

BLOOD SUPPLY.—Brachial artery.

Subanconeus.—DESCRIPTION.—The Subanconeus is a name given to a few fibers from the under surface of the lower part of the Triceps muscle. By some authors it is regarded as the analogue of the *Suberureus* in the lower limb, but it is not a separate muscle.

ORIGIN.—Humerus above olecranon fossa.

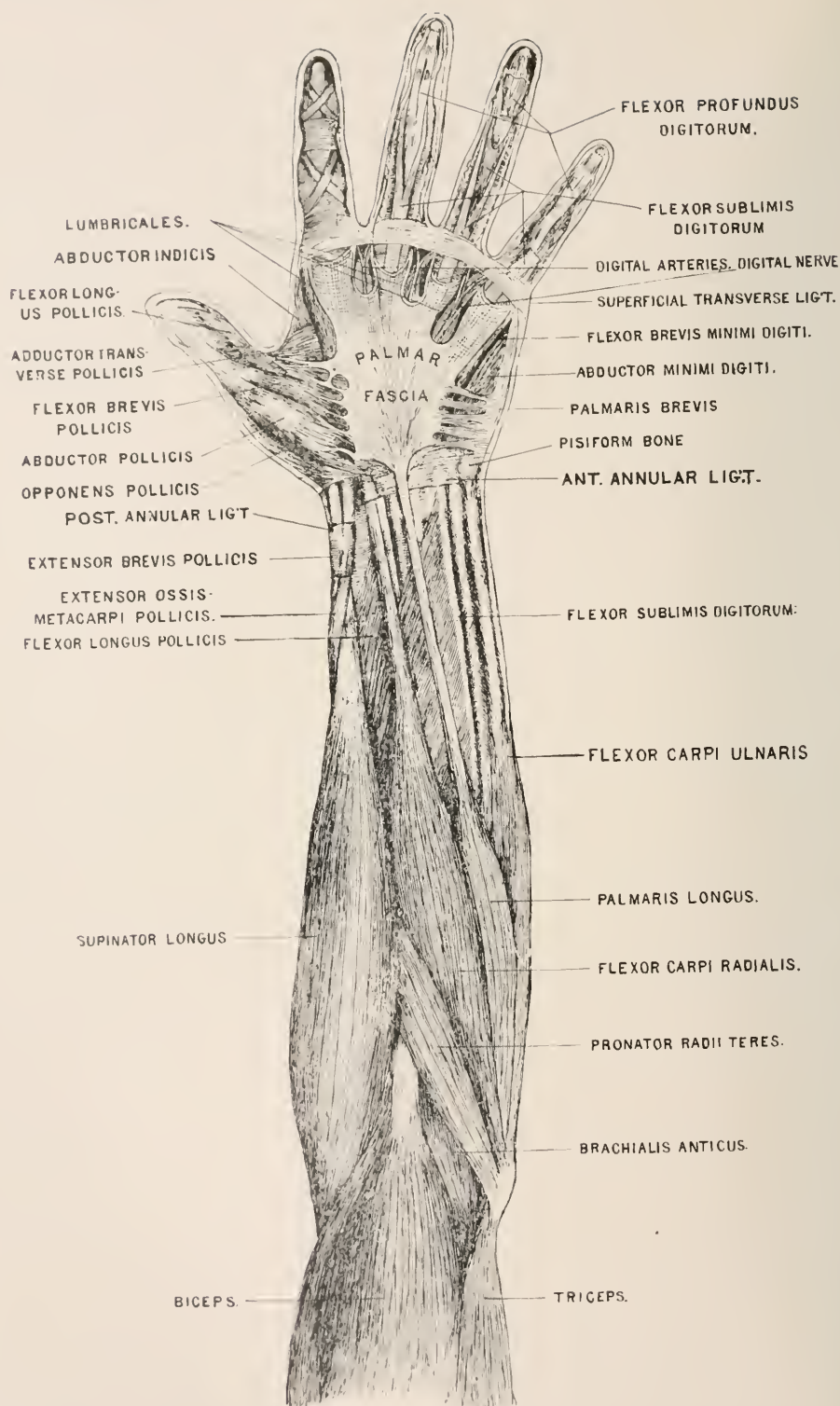
INSERTION.—Posterior ligament of elbow-joint.

ACTION.—Draws up posterior ligament during extension of forearm.

NERVE SUPPLY.—Musculo-spiral.

BLOOD SUPPLY.—Brachial artery.

Pronator radii teres.—DESCRIPTION.—(Plate XXIX.)—This muscle arises by two heads, between which the median nerve enters the forearm. It passes obliquely across the forearm from the inner to the outer side, and ter-



MUSCLES OF THE LEFT FOREARM—FIRST LAYER—ANTERIOR VIEW

minates in a flat tendon which turns over the outer margin of the radius.

ORIGIN.—One head, (1) immediately above internal condyle of humerus; (2) common tendon; (3) fascia; (4) intermuscular septum. The other head, thin fasciculus from inner side of coronoid process of ulna, joining first head at an acute angle. (Plate XXIII.)

INSERTION.—Rough impression on middle of outer surface of shaft of radius. (Plate XXV.)

ACTION.—To pronate hand.

NERVE SUPPLY.—Median.

BLOOD SUPPLY.—Radial artery.

Flexor carpi radialis.—**DESCRIPTION.**—(Plate XXIX.)—This muscle lies on the inner side of the preceding muscle. It is slender and aponeurotic in structure at its commencement above, but increases in size and terminates in a tendon which forms rather more than the lower half of its length. This tendon passes through a canal on the outer side of the annular ligament and runs through a groove in the os trapezium. The radial artery lies between the tendon and the Supinator longus muscle, and may easily be tied in this situation.

ORIGIN.—(1) Internal condyle by common tendon; (2) fascia; (3) intermuscular septum. (Plate XXIII.)

INSERTION.—(Plate XXVII.)—Bases of metacarpals of index and middle fingers.

ACTION.—Flexor of wrist.

NERVE SUPPLY.—Median.

BLOOD SUPPLY.—Radial artery.

LESSON XIX.

Palmaris longus.—**DESCRIPTION.**—(Plate XXIX.)—This is a slender, fusiform muscle lying on the inner side of the preceding. It is often absent and is subject to much variation; it may be tendinous above and muscular below; or it may be muscular in the center with a tendon above and below; or it may present two muscular bundles with a central tendon; or finally, it may consist simply of a mere tendinous band.

ORIGIN.—(1) Inner condyle of humerus by the common tendon; (2) deep fascia; (3) intermuscular septa. (Plate XXIII.)

INSERTION.—Palmar fascia and occasionally a tendinous ligament to short muscles of thumb. (Plate XXIX.)

ACTION.—Tenses palmar fascia.

NERVE SUPPLY.—Median.

BLOOD SUPPLY.—Radial and ulnar arteries.

Flexor carpi ulnaris.—**DESCRIPTION.**—This muscle lies along the ulnar side of the forearm. It arises by two heads connected by a tendinous arch, beneath which pass the ulnar nerve and posterior ulnar recurrent artery. The fibers terminate in a tendon which occupies the anterior part of the lower half of the muscle. The ulnar artery lies on the outer side of this tendon, in the lower two-thirds of the forearm. (Plates XXIX-XV.)

ORIGIN.—One head from internal condyle of humerus by common tendon; the other from inner margin of olecranon, upper two-thirds of posterior border of ulna by an aponeurosis common to it, the Extensor carpi ulnaris, and Flexor profundus digitorum, and also from the intermuscular septum. (Plate XXIII.)

INSERTION.—Pisiform bone, annular ligament, and base of fifth metacarpal and unciform bones. (Plate XXVII.)

ACTION.—Flexes wrist.

NERVE SUPPLY.—Ulnar.

BLOOD SUPPLY.—Ulnar artery.

Flexor sublimis digitorum (perforatus).—**DESCRIPTION.**—(Plates XXX.)—This muscle lies just beneath the preceding and is the largest of the muscles of the superficial layer. It arises by three heads. The fibers pass vertically downward, forming a broad and thick muscle which speedily divides into two planes of muscular fibers, superficial and deep. The superficial plane divides into two parts which end in tendons for the middle and ring fingers; the deep plane also divides into two parts which end in tendons for the index and little fingers, but previous to having done so it gives off a muscular slip which joins that part of the superficial plane which is intended for the ring finger. As the four tendons thus formed pass beneath the annular ligament into the palm of the hand they are arranged in pairs, the superficial pair corresponding to the middle and ring fingers, the deep pair to the index and little fingers. The tendons diverge as they pass onward. Opposite the bases of the first phalanges each tendon divides into two slips to allow the passage of the corresponding tendon of the Flexor profundus digitorum; the two portions then unite and form a grooved channel for the reception of the deep flexor tendon. Finally they subdivide a second time prior to their insertion.

ORIGIN.—(By three heads) first head, (1) internal condyle of humerus by common tendon; (2) internal lateral ligament of elbow-joint; and (3) intermuscular septum. Second head, inner side of coronoid process of ulna. Third head, oblique line of radius, from the tubercle to the insertion of the Pronator radii teres. (Plates XXV-XXIII.)

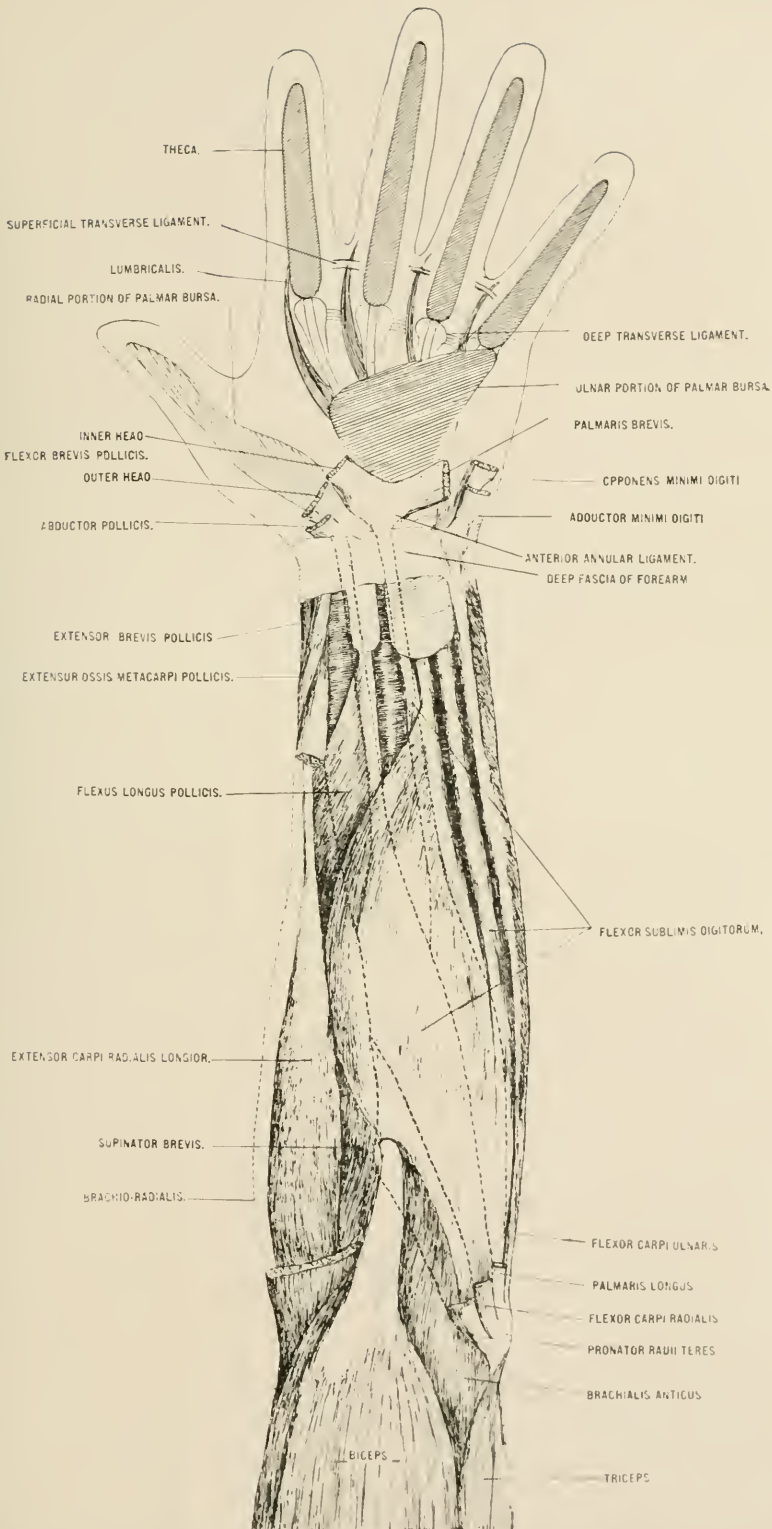
INSERTION.—(Plate XXVII.)—Lateral margins of second phalanges about their middle.

ACTION.—Flexes second phalanges.

NERVE SUPPLY.—Median.

BLOOD SUPPLY.—Radial and ulnar arteries.

Flexor profundus digitorum.—**DESCRIPTION.**—(Plate XXXI.) This muscle is situated on the ulnar side of the forearm, immediately beneath the superficial flexors. Its fibers form a fleshy belly of considerable size which divides into four tendons; these pass under the annular ligament beneath the tendons of the Flexor sublimis digitorum. Opposite the first phalanges the tendons pass through the openings in the two slips of the tendons of the Flexor sublimis digitorum. The portion of the muscle for the index finger is usually distinct throughout, but the tendons for the three inner fingers are connected together by cellular tissue and tendinous slips as far as the palm of the hand. Four small muscles, the Lumbricales, are connected with the tendons of the Flexor profundus in the palm.



MUSCLES OF THE LEFT FOREARM—SECOND LAYER—ANTERIOR VIEW

ORIGIN.—(1) Upper three-fourths of shaft of ulna, anterior and inner surfaces; (2) depression on inner side of coronoid process; (3) by aponeurosis from upper three-fourths of posterior border of ulna; and (4) ulnar half of interosseous membrane. (Plate XXV.)

INSERTION.—Bases of last phalanges. (Plate XXVII.)

ACTION.—Flexes phalanges.

NERVE SUPPLY.—Eighth cervical and first dorsal through ulnar, and the anterior interosseous branch of median.

BLOOD SUPPLY.—Ulnar artery.

Flexor longus pollicis.—**DESCRIPTION.**—(Plate XXXI.)—This muscle is situated on the radial side of the forearm, lying on the same plane as the preceding. The fibers pass downward and terminate in a flattened tendon which passes beneath the annular ligament and is then lodged in the interspace between the outer head of the Flexor brevis pollicis and the Adductor obliquus pollicis. The anterior interosseous vessels and nerve lie between this muscle and the Flexor profundus digitorum.

ORIGIN.—From the grooved anterior surface of the shaft of the radius, from the tuberosity and oblique line to within a short distance of the Pronator quadratus; also from the adjacent part of the interosseous membrane, and generally by a fleshy slip from the inner border of the coronoid process of ulna, or from the internal condyle of the humerus. (Plate XXV.)

INSERTION.—Base of last phalanx of thumb. (Plate XXVII.)

ACTION.—Flexes thumb.

NERVE SUPPLY.—Eighth cervical and first dorsal through the anterior interosseous branch of the median.

BLOOD SUPPLY.—Radial artery.

Pronator quadratus.—**DESCRIPTION.**—(Plate XXXI.)—This is a small, flat, quadrilateral muscle extending transversely across the front of the radius and ulna, above their carpal extremities.

ORIGIN.—(1) Oblique ridge on lower part of anterior surface of ulna; (2) lower fourth of anterior surface and anterior border of ulna; and (3) strong aponeurosis covering inner third of muscle. (Plate XXV.)

INSERTION.—(Plate XXV.)—Lower fourth of anterior surface and anterior border of shaft of radius.

ACTION.—Pronates the hand.

NERVE SUPPLY.—Eighth cervical and first dorsal through anterior interosseous branch of median.

BLOOD SUPPLY.—Radial and ulnar arteries.

LESSON XX.

Supinator longus.—**DESCRIPTION.**—(Plate XXXII.)—The Supinator longus (Brachio-radialis) is the most superficial muscle on the radial side of the forearm; it is fleshy for the upper two-thirds of its extent, tendinous below, the tendon commencing above the middle of the forearm. Its inner border, above the elbow, is in relation with the musculo-spiral nerve and radial recurrent artery, and in the forearm with the radial vessels and nerve.

ORIGIN.—Upper two-thirds of external supracondylar ridge of humerus and external intermuscular septum. (Plate XXIII.)

INSERTION.—Outer side of base of styloid process of radius. (Plate XXV.)

ACTION.—Supinates hand.

NERVE SUPPLY.—Sixth cervical through the musculo-spiral nerve.

BLOOD SUPPLY.—Brachial and radial arteries.

Extensor carpi radialis longior.—**DESCRIPTION.**—(Plate XXXII.)—This muscle lies partly beneath the Supinator longus, its fibers terminating at the upper third of the forearm in a flat tendon which runs along the outer border of the radius beneath the extensor tendons of the thumb. It then passes through a groove common to it and the Extensor carpi radialis brevior, immediately behind the styloid process of the radius.

ORIGIN.—From the lower third of the external supracondylar ridge of the humerus and from the external intermuscular septum by a few fibers from the common tendon of origin of the extensor muscles of the forearm. (Plate XXIII.)

INSERTION.—Base of metacarpal of index finger, radial side. (Plate XXVI.)

ACTION.—Extends the wrist.

NERVE SUPPLY.—Sixth and seventh cervical through the musculo-spiral.

BLOOD SUPPLY.—Radial artery.

Extensor carpi radialis brevior.—**DESCRIPTION.**—(Plates XXXII.)—This muscle is shorter and thicker than the preceding, beneath which it is placed. Its fibers terminate about the middle of the forearm in a flat tendon which is closely connected with that of the Longior, and accompanies it to the wrist, lying in the same groove on the posterior surface of the radius; it passes beneath the extensor tendons of the thumb, then beneath the annular ligament.

The tendons of the two preceding muscles pass through the same compartment of the annular ligament and are lubricated by a single synovial membrane, but are separated from each other by a small vertical ridge of bone as they lie in the groove at the back of the radius.

ORIGIN.—From the external condyle of the humerus by a tendon common to it and the three following muscles: from the external lateral ligament of the elbow-joint, from a strong aponeurosis which covers its surfaces, and from the intermuscular septa. (Plate XXIII.)

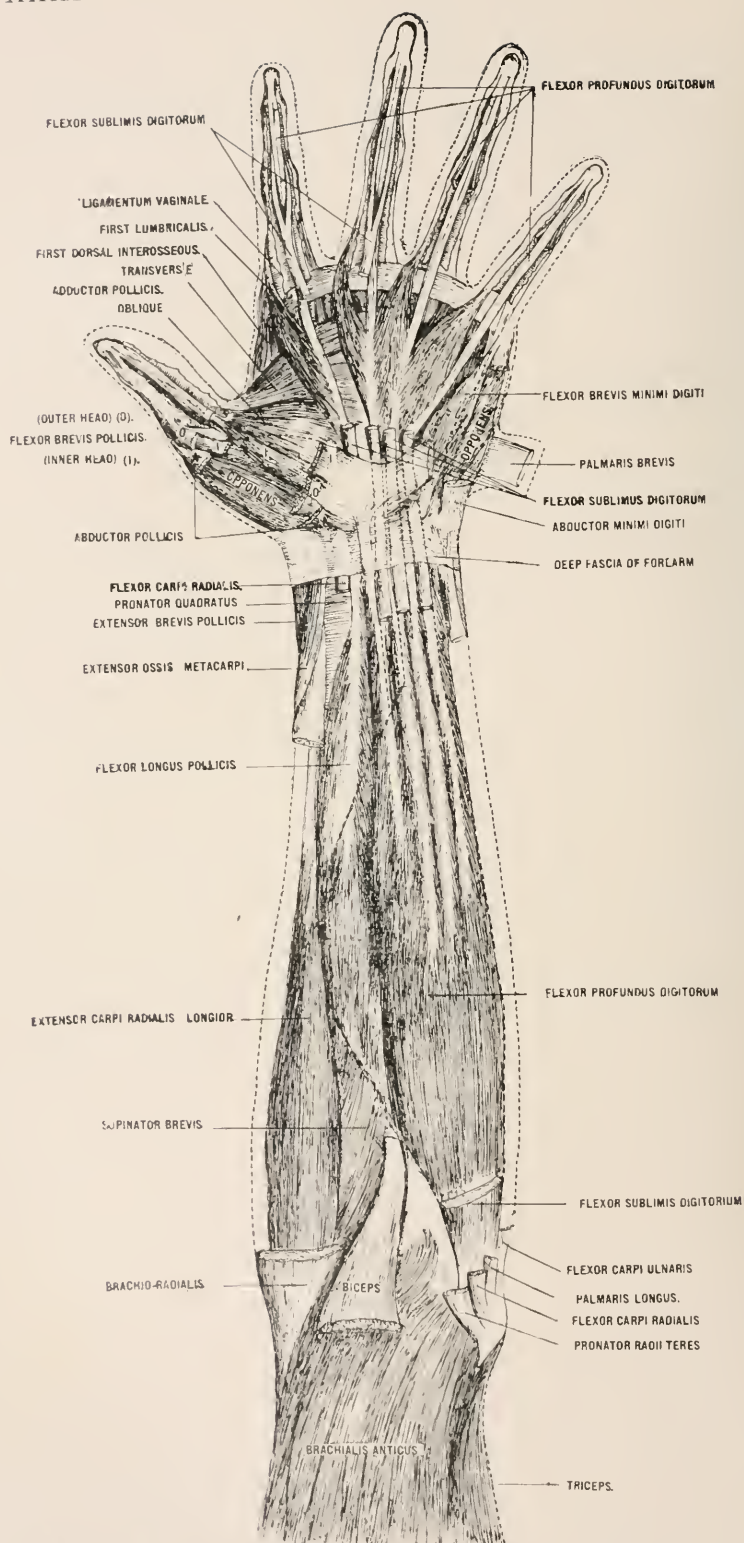
INSERTION.—(Plate XXVI.)—Base of metacarpal bone of middle finger on its radial side.

ACTION.—It assists the Extensor carpi radialis longior in extending the wrist and may also act slightly as an abductor of the hand.

NERVE SUPPLY.—Sixth and seventh cervical through the posterior interosseous.

BLOOD SUPPLY.—Radial artery.

Extensor communis digitorum.—**DESCRIPTION.**—(Plates XXXII.)—This muscle is situated at the back part of the forearm and divides just below the middle into three fleshy masses, from which tendons proceed; these pass together with the Extensor indicis through a separate compartment of the annular ligament. The tendons then diverge, the innermost one dividing into two.



MUSCLES OF THE LEFT FOREARM—THIRD AND FOURTH LAYERS—ANTERIOR VIEW

Each tendon opposite the metacarpo-phalangeal articulation becomes narrow and thickened and gives off a thin fasciculus upon each side of the joint, which blends with the lateral ligament and serves as a posterior ligament; after having passed the joint it spreads out into a broad aponeurosis which covers the whole of the dorsal surface of the first phalanx, being reinforced in this situation by the tendons of the Interossei and Lumbricales. Opposite the first phalangeal joint this aponeurosis divides into three slips, a middle and two lateral.

ORIGIN.—(1) External condyle of humerus by common tendon; (2) deep fascia; (3) intermuscular septum. (Plate XXIII.)

INSERTION.—Into the second and third phalanges of the fingers in the following manner; the outermost tendon accompanied by the Extensor indicis, goes to the index finger; the second tendon is sometimes attached to the first by a thin transverse band and receives a slip from the third tendon: it goes to the middle finger; the third tendon gives off a slip to the second and receives a very considerable part of the fourth tendon; the fourth or innermost tendon, after dividing, sends one slip to join the third tendon; the other, reinforced by the Extensor minimi digiti, goes to the little finger. After the division of the aponeurosis opposite the phalangeal joint, the middle slip is inserted into the base of the second phalanx, while the two lateral are continued onward along the sides of the second phalanx and are inserted into the dorsal surface of the last phalanx. (Plate XXVI.)

ACTION.—To extend the fingers.

NERVE SUPPLY.—Seventh cervical through the posterior interosseous.

BLOOD SUPPLY.—Posterior interosseous.

Extensor minimi digiti.—**DESCRIPTION.**—(Plate XXXII.)—This is a slender muscle placed on the inner side of the Extensor communis digitorum with which it is generally connected. Its tendon runs through a separate compartment in the annular ligament behind the inferior radio-ulnar joint, then divides into two as it crosses the hand, the outermost division being joined by the slip from the innermost tendon of the common extensor. The two slips thus formed spread into a broad aponeurosis and receive a slip from the Abductor minimi digiti.

ORIGIN.—Common tendon by a thin tendinous slip and intermuscular septa. (Plate XXIII.)

INSERTION.—Second and third phalanges of the little finger. (Plate XXVI.)

ACTION.—Extends the little finger.

NERVE SUPPLY.—Seventh cervical through the posterior interosseous.

BLOOD SUPPLY.—Posterior interosseous and radial.

Anconeus.—**DESCRIPTION.**—This is a small triangular muscle placed behind and below the elbow-joint, and appears to be a continuation of the external portion of the Triceps. Its fibers diverge from their origin, the upper ones being directed transversely, the lower obliquely inward. (Plate XXXII.)

ORIGIN.—External condyle of humerus posteriorly. (Plate XXII.)

INSERTION.—Side of olecranon process and upper fourth of posterior surface of shaft of ulna. (Plate XXIV.)

ACTION.—Extends forearm.

NERVE SUPPLY.—Seventh and eighth cervical through the musculo-spiral.

BLOOD SUPPLY.—Radial and superior profunda.

LESSON XXI.

Supinator brevis.—**DESCRIPTION.**—(Plate XXXIII.)—This is a broad muscle of hollow cylindrical form, curved round the upper third of the radius. It consists of two distinct planes of muscular fibers, between which lies the posterior interosseous nerve. The two planes arise in common. The fibers of the deeper plane form a sling-like fasciculus, which encircles the neck of the radius above the tuberosity. Between the insertion of the two planes the posterior interosseous nerve lies on the shaft of the bone.

ORIGIN.—The superficial plane by tendinous and the deep by muscular fibers from (1) the external condyle of the humerus; (2) external lateral ligament of elbow-joint; (3) orbicular ligament of radius; (4) oblique ridge of ulna; (5) triangular depression in front of the ridge; (6) tendinous expansion covering the surface of the muscle. (Plates XXIII-XXIV.)

INSERTION. The superficial fibers into the outer edge of the bicipital tuberosity and oblique line of the radius; the deeper fibers into the posterior and external surface of the shaft, midway between the oblique line and head of the bone, except the sling-like fasciculus which is attached to the back part of the inner surface of the radius. (Plate XXIV.)

ACTION.—Supinates hand.

NERVE SUPPLY.—Posterior interosseous.

BLOOD SUPPLY.—Interosseous and radial arteries.

Extensor ossis metacarpi pollicis.—**DESCRIPTION.**—(Plate XXXIII.)—This is the most external and the largest of the deep extensor muscles. It lies immediately below the supinator brevis, with which it is sometimes united. From its origin it passes obliquely downward and outward and terminates in a tendon which runs through a groove on the outer side of the styloid process of the radius. The tendon of the Extensor brevis pollicis lies in the same groove. The Extensor pollicis occasionally gives off two slips near its insertion, one to the trapezium, and the other to blend with the origin of the Abductor pollicis.

ORIGIN.—From outer part of posterior surface of shaft of ulna below insertion of Anconeus, from the interosseous membrane, and from the middle third of the posterior surface of shaft of radius. (Plate XXIV.)

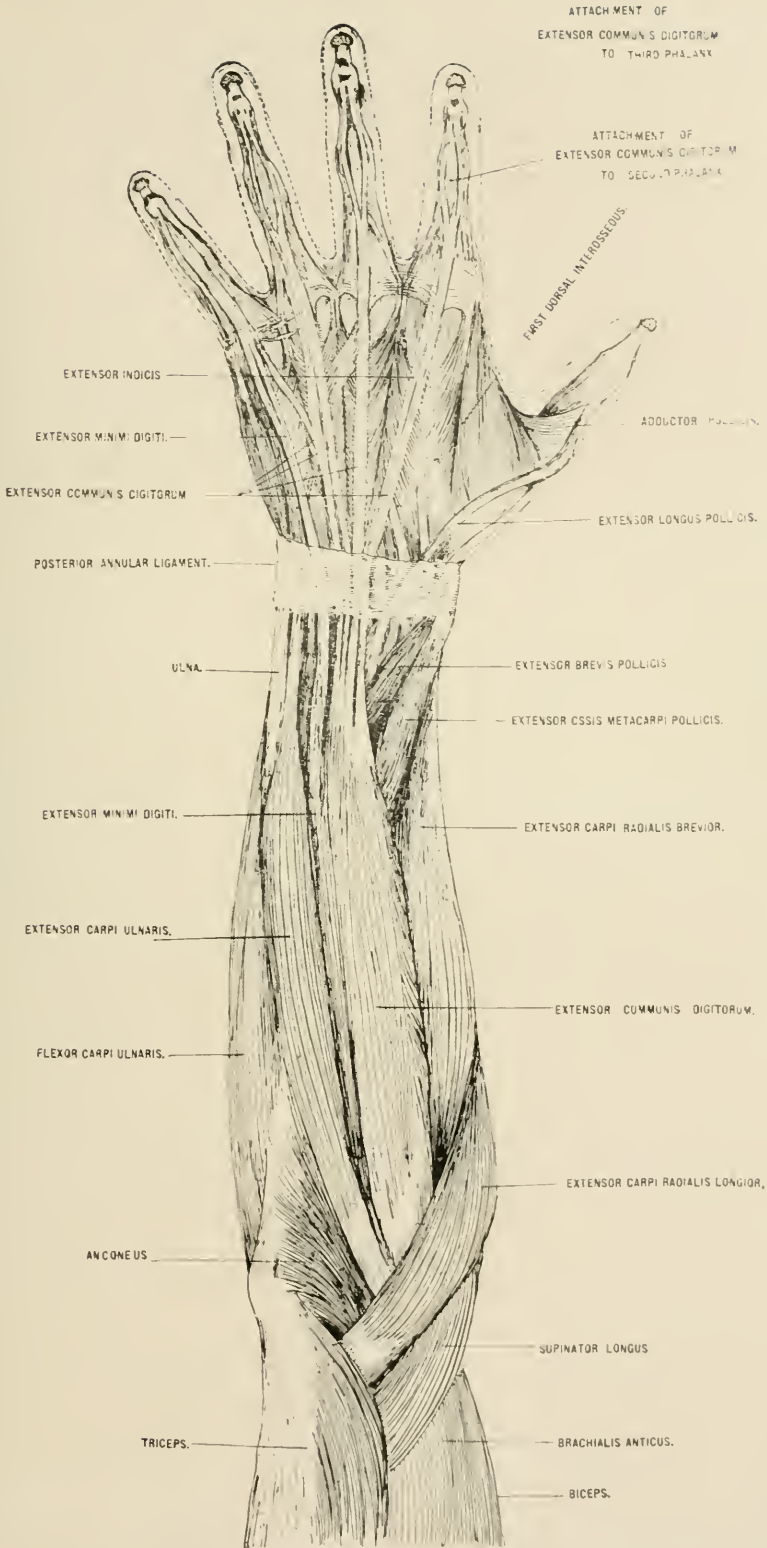
INSERTION.—Base of metacarpal bone of thumb. (Plate XXVII.)

ACTION.—Extends thumb.

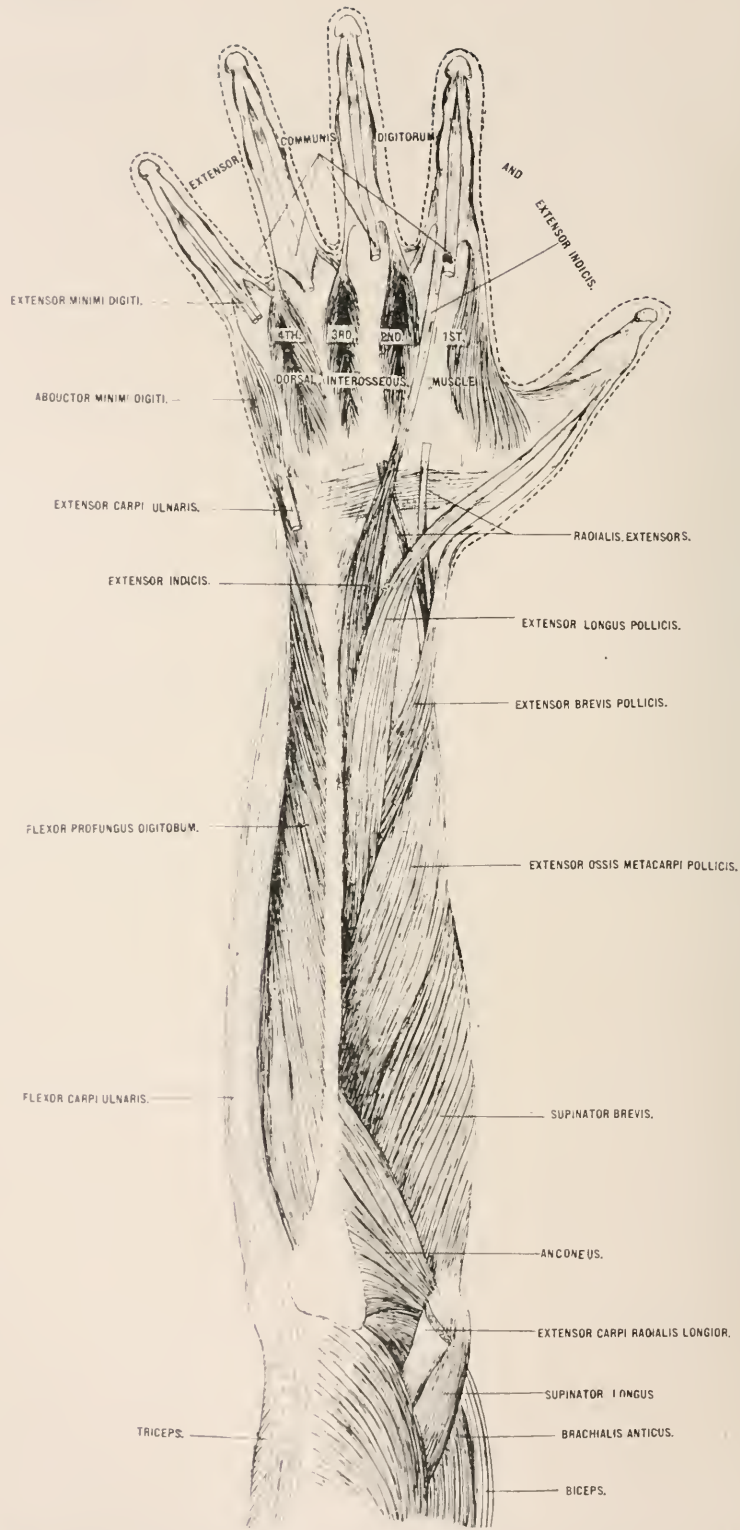
NERVE SUPPLY.—Posterior interosseous.

BLOOD SUPPLY.—Posterior interosseous.*

Extensor brevis pollicis.—**DESCRIPTION.**—(Plate XXXIII.)—The Extensor brevis pollicis (Extensor primi internodii pollicis) the smallest muscle of this group, lies on the inner side of the preceding, having a similar direction and passing through the same groove on the outer side of the styloid process.



MUSCLES OF THE LEFT FOREARM—SUPERFICIAL LAYER—POSTERIOR VIEW



MUSCLES OF THE LEFT FOREARM—DEEP LAYER—POSTERIOR VIEW

ORIGIN.—Posterior surface of shaft of radius, below Extensor ossis metacarpi pollicis and from the interosseous membrane. (Plate XXIV.)

INSERTION.—Base of first phalanx of thumb. (Plate XXVI.)

ACTION.—Extends the proximal phalanx of thumb.

NERVE SUPPLY.—Seventh cervical through the posterior interosseous.

BLOOD SUPPLY.—Posterior interosseous artery.

Extensor longus pollicis.—**DESCRIPTION.**—(Plate XXXIII.)—The Extensor longus pollicis (Extensor secundi internodii pollicis) is much larger than the preceding muscle, the origin of which it partly covers in. It terminates in a tendon which passes through a separate compartment in the annular ligament, lying in a narrow, oblique groove at the back part of the lower end of the radius. It then crosses obliquely the tendons of the Extensor carpi radialis longior and brevior, being separated from the other extensor tendons of the thumb by a triangular interval in which the radial artery is found.

ORIGIN.—Outer part of posterior surface of shaft of ulna distally from origin of Extensor ossis metacarpi pollicis and from interosseous membrane. (Plate XXIV.)

INSERTION.—Base of last phalanx of thumb. (Plate XXVI.)

ACTION.—Extends thumb.

NERVE SUPPLY.—Seventh cervical through posterior interosseous.

BLOOD SUPPLY.—Posterior interosseous artery.

Extensor indicis.—**DESCRIPTION.**—(Plate XXXIII.)—This is a narrow, elongated muscle placed on the inner side of, and parallel with the preceding. Its tendon passes with the Extensor communis digitorum through the same canal in the posterior annular ligament and subsequently joins the tendon of the Extensor communis digitorum which belongs to the index finger, opposite the lower end of the corresponding metacarpal bone, lying to the ulnar side of the tendon from the common extensor.

ORIGIN.—Shaft of ulna posteriorly, and distally from Extensor longus pollicis and from interosseous membrane. (Plate XXIV.)

INSERTION.—Second and third phalanges of index finger with tendon of common extensor. (Plate XXVI.)

ACTION.—Extends index finger.

NERVE SUPPLY.—Seventh cervical through posterior interosseous.

BLOOD SUPPLY.—Posterior interosseous artery.

LESSON XXII.

Radial artery.—The radial artery extends from the bifurcation of the brachial and ends in the deep palmar arch. Its course is shown by a line from a point about half an inch below the middle of the bend of the elbow to the inner side of the base of the styloid process of the radius. This artery is more a continuation of the brachial than the ulnar, which is more of a branch. It is accompanied by venae comites. Its branches in the forearm are radial recurrent, muscular, superficialis volae, and anterior carpal.

The **radial recurrent** arises from the radial just below the elbow, passes outward between the Supinator brevis and Supinator longus, also separating the radial and posterior interosseous nerves; it then runs towards the elbow between the Supinator longus and the Brachialis anticus to supply these muscles and to anastomose with the anterior terminal branch of the superior profunda.

The **muscular branches** supply the muscles on the radial side of the forearm.

The **anterior carpal** arises near the lower border of the Pronator quadratus; it passes to the ulnar side of the forearm under the tendons to anastomose with anterior carpal of ulnar, thus forming the loop which gives branches to the wrist-joint.

The **superficialis volae** arises from the artery near the wrist where it is about to wind around the carpus. It passes between the muscles of the ball of the thumb, sometimes over them. It anastomoses with the ulnar, completing the superficial palmar arch. The pulse may often be felt in this artery, as well as in the radial, when it arises higher than usual.

The **branches** in the wrist are the posterior carpal, metacarpal or first dorsal interosseous, dorsales pollicis, and dorsalis indicis. After the radial gives off the anterior carpal it crosses the external lateral ligament to the base of the metacarpal of the thumb, lying upon the scaphoid and trapezium. In this situation it is crossed by the three extensors of the thumb, viz., Extensor ossis metacarpi pollicis which is a broad muscle and comes from both bones, the Extensor longus pollicis which comes from the long bone or ulna, and the Extensor brevis pollicis which comes from the short bone or radius. It then passes between the two heads of the first dorsal interosseous or Abductor indicis, into the palm. It passes to the back of the hand for two reasons, first to supply the back of the hand on the radial side, and second for protection.

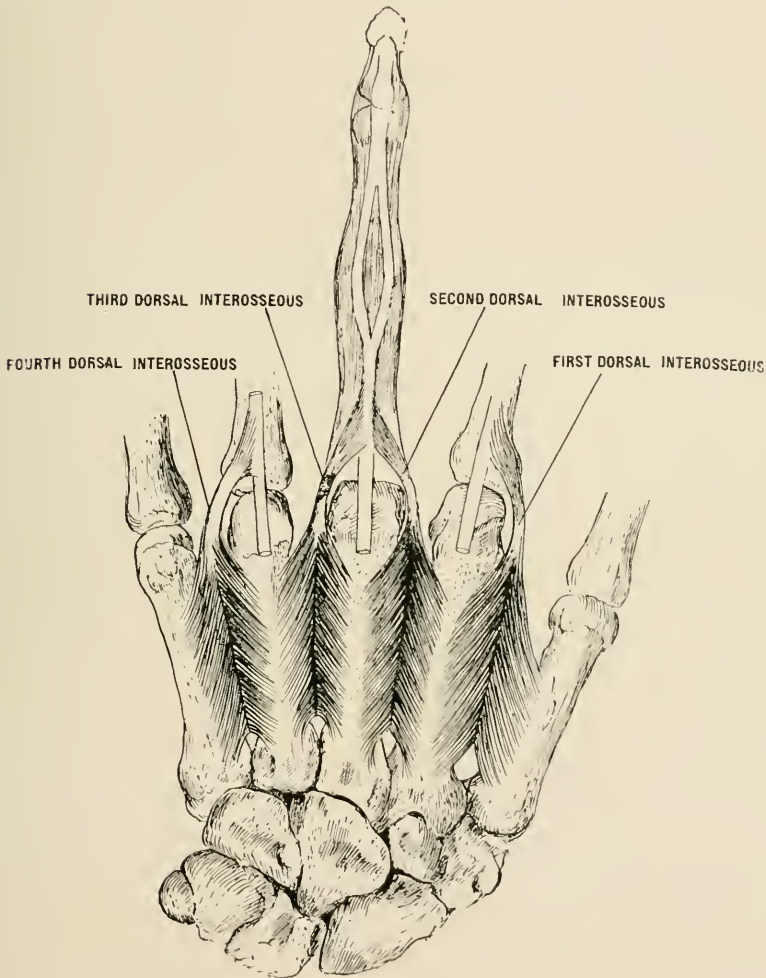
The **posterior carpal** arises beneath the extensors of the thumb, passing beneath the extensor tendons of the forearm to join the posterior carpal of the ulnar, making the posterior carpal arch. It gives off the second and third dorsal interossei which pass on the back of the Third and Fourth interossei muscles to the metacarpo-phalangeal joint where it divides into digital branches to supply the contiguous sides of the middle, ring, and little fingers. At their proximal extremity they receive perforating branches from the deep palmar arch. At the distal extremity they give perforating branches to the digital branches to join the palmar digital arteries.

The **metacarpal or first dorsal interosseous** may come from the posterior carpal, but it generally arises from the radial. It passes over the Second dorsal interosseous muscle to the metacarpo-phalangeal joint where it is divided to supply the contiguous sides of the index and middle fingers. At its proximal extremity it receives perforating branches from the deep palmar arch; at its distal extremity it gives branches to join the corresponding digital arteries. The digital arteries end at the first interphalangeal joint where they join the posterior branch of the collateral digital branches.

The **dorsales pollicis** are two in number; they arise from the radial near the base of the first metacarpal bone and pass along the sides of the dorsum of the thumb.

The **dorsalis indicis** arises from the radial just before it passes between the two heads of the Abductor indicis; it then passes over the dorsum of this muscle, which it supplies, to the radial side of the index finger. At the first interphalangeal joint it anastomoses with the posterior branch of the radialis indicis.

PLATE XXXIV



THE FOUR DORSAL INTEROSSEI

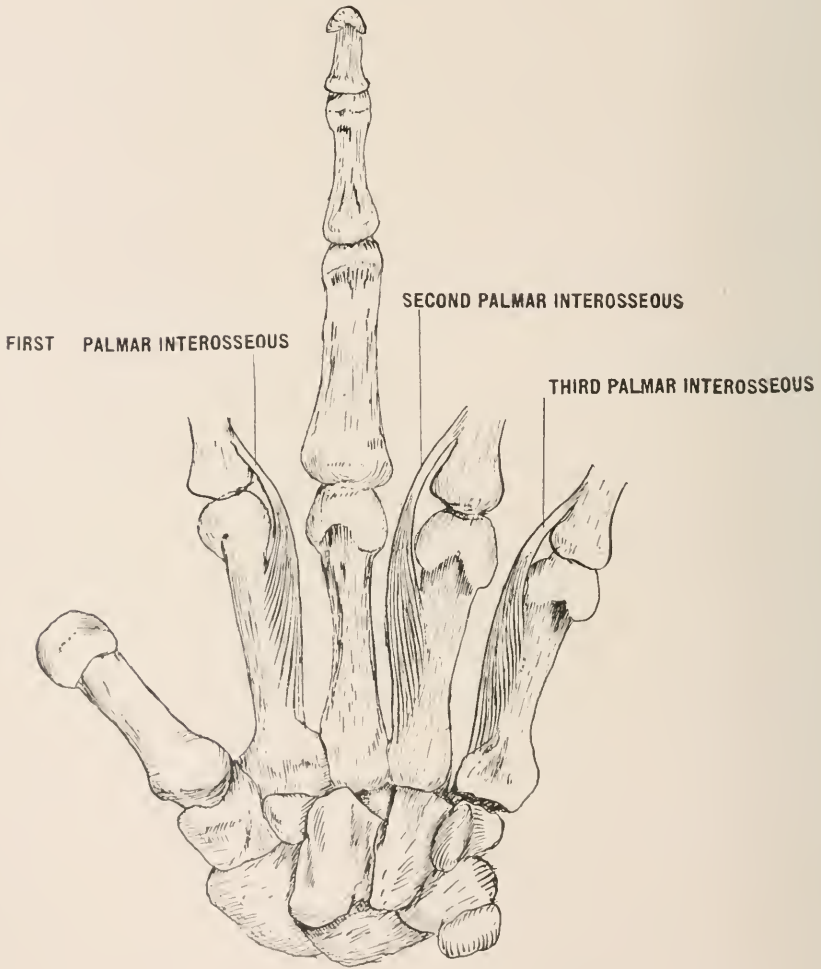
The **deep palmar arch** is formed by the radial, after it passes between the two heads of the Abductor indicis, and a terminal branch of the ulnar. This arch has its convexity distally; it lies upon the bases of the metacarpal bones. It has five branches, four from the convexity and one from the concavity.

The **princeps pollicis** first passes between the Abductor indicis and the

Flexor brevis pollicis to the distal extremity of the metacarpal of the thumb where it divides, sending a branch on each side of the palmar aspect of the thumb.

The **radialis indicis** is next from the convexity; it passes along the radial aspect of the palmar surface of the index finger, at first it passes between the Abductor indicis and Adductor pollicis.

PLATE XXXV



THE THREE PALMAR INTEROSSEI

The **palmar interossei** are three in number. They pass over the Second, Third, and Fourth palmar Interossei just before they divide into collateral digital branches. They join the corresponding digital branches of the superficial palmar arch.

The **superior perforating** are three in number. They pass between the

two heads of the Three inner dorsal interossei to join the dorsal interosseous arteries.

The **palmar recurrent**, two or three, pass towards the wrist and join the anterior carpal and anterior interosseous to supply the wrist-joint.

Relations of the Radial Artery in the Forearm.

IN FRONT.—(1) Skin, (2) Superficial and deep fasciae, (3) Supinator longus.

BEHIND.—(1) Tendon of Biceps, (2) Supinator brevis, (3) Pronator radii teres, (4) Flexor sublimis digitorum, (5) Flexor longus pollicis, (6) Pronator quadratus, (7) radius.

OUTER SIDE.—(1) Supinator longus, (2) Radial nerve (middle third).

INNER SIDE.—(1) Pronator radii teres, (2) Flexor carpi radialis.

LESSON XXIII.

Ulnar artery.—The ulnar artery is a branch of the brachial about one-half an inch below the bend of the elbow. It is larger than the radial, which seems to be a continuation of the brachial. It passes over the anterior annular ligament on the radial or outer side of the pisiform bone.

The **anterior ulnar recurrent** arises from the ulnar just below its origin. It passes towards the elbow upon the Brachialis anticus and under the Pronator radii teres to the front of the internal condyle to anastomose with the anterior branch of the inferior profunda and the anastomotica magna.

The **posterior ulnar recurrent** is the larger of the vessels and has its origin below the anterior. It passes backward and inward upon the Flexor sublimis digitorum. It passes between the two heads of Flexor carpi ulnaris, with the ulnar nerve, to the back of the internal condyle to anastomose with the posterior branch of the inferior profunda and the anastomotica magna.

The **common interosseous** is the next in order, having its origin opposite the bicipital tuberosity. It passes upward and distally to the beginning of the interosseous membrane where it divides into anterior interosseous and posterior interosseous. The lumen of this branch is the largest of the branches.

The **anterior interosseous** passes to the distal extremity of the interosseous membrane in company with the anterior interosseous nerve, where it passes to the back of the forearm. It has venae comites. It sends a branch with the median nerve called the median artery or *comes nervi mediani*. At the wrist it anastomoses with the anterior carpal artery and recurrent branches from the deep palmar arch. It may help to form the superficial palmar arch. It gives nutrient branches to both the radius and ulna.

The **posterior interosseous** artery passes to the back of the forearm between the oblique ligament and interosseous membrane. It passes between the Supinator brevis and the Extensor ossis metacarpi pollicis, then lies between the two layers of muscles on posterior part of forearm as far as the wrist. It lies internal to posterior interosseous nerve. It anastomoses with the carpal of radial and ulnar, and anterior interosseous arteries. It gives off the posterior interosseous recurrent which passes under the Anconeus to the interval between olecranon and external condyle, where it anastomoses with the superior profunda, the anastomotica magna and posterior ulnar recurrent.

The **muscular branches** vary in number and supply the adjacent muscles.

The **anterior carpal** is a small branch which has its origin at the distal part of the ulnar artery near the anterior annular ligament. It passes outward to anastomose with the anterior carpal of the radial. These two arteries make the anterior carpal arch. It anastomoses with the anterior interosseous, and recurrent branches from the deep palmar arch. It lies beneath the tendons of the *Flexor profundus digitorum*.

The **posterior carpal** arises a little proximally of the pisiform bone. It passes beneath the *Extensor carpi ulnaris* to the back of the wrist to join the posterior carpal of the radial under the extensor tendons.

The **superficial palmar arch** is made by the continuation of the ulnar in the hand, joining the *superficialis volae*, or the *radialis indicis*, or the *princeps pollicis*, rarely joining a large median artery.

The **deep ulnar branch** passes between the *Abductor minimi digiti* and the *Flexor brevis minimi digiti* to make the deep palmar arch. The convexity of the superficial palmar arch gives four digital branches, one to the ulnar side and palmar aspect of the little finger, and the other three to the adjacent sides of the little, ring, middle and index fingers. On the fingers these arteries are posterior to the nerves.

Relations of the Ulnar Artery in the Forearm.

IN FRONT.—Upper half.—(1) Superficial layer of flexor muscles, (2) Median nerve. Lower half—(3) Superficial fascia, (4) Deep fascia.

BEHIND.—(1) *Brachialis anticus*, (2) *Flexor profundus digitorum*.

OUTER SIDE.—*Flexor sublimis digitorum*.

INNER SIDE.—(1) *Flexor carpi ulnaris*, (2) Ulnar nerve (lower two-thirds.)

Relations of the Superficial Palmar Arch.

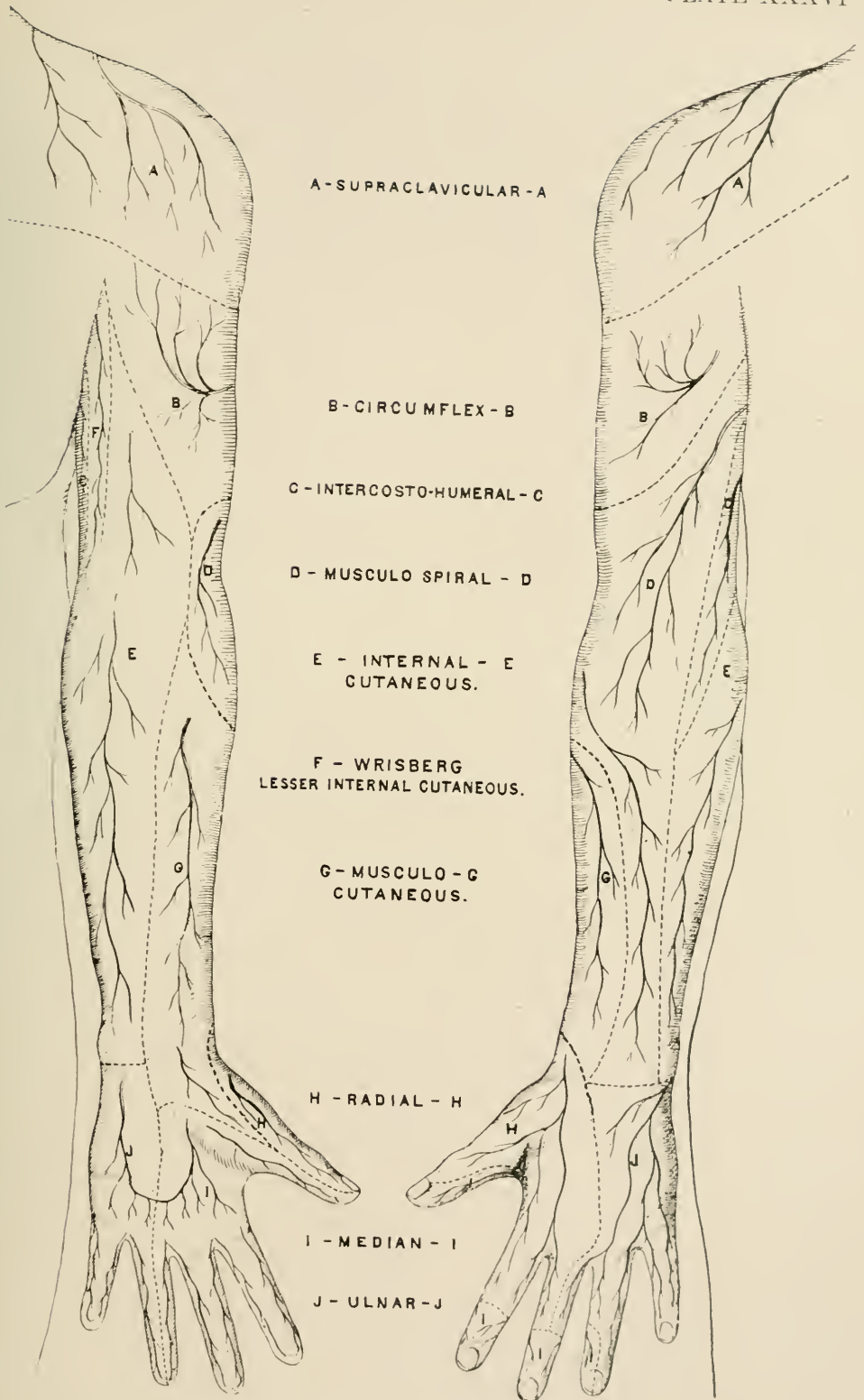
IN FRONT.—(1) Skin, (2) *Palmaris brevis*, (3) Palmar fascia.

BEHIND.—(1) Annular ligament, (2) *Flexor brevis minimi digiti*, (3) Superficial flexor tendons, (4) Divisions of median and ulnar nerves.

BRACHIAL PLEXUS.

LESSON XXIV.

A **plexus** is a net-work. The Brachial Plexus is a net-work of nerves situated in the axilla. Its branches supply the upper extremity. It is called "brachial" because it supplies the arm or brachium. It is composed of the anterior primary branches (Principle IV Lesson III) of the fifth, sixth, seventh, eighth cervical and first dorsal nerves. The anterior branches of the fifth and sixth cervical nerves make the first trunk. The anterior branch of the seventh cervical nerve makes the second trunk. The anterior branches of the eighth cervical nerve and part of the first dorsal nerve make the third trunk. These trunks divide into anterior and posterior branches (secondary). The anterior branches of the first and second trunk make the outer cord; the anterior branch of the third trunk makes the inner cord; and the posterior branches of all three trunks make the posterior cord. They are called outer, inner, and posterior cords of the brachial plexus on account of occupying that relation to the second part of the axillary artery. (Plates VI-XVI-XVII.)



SHOWING THE CUTANEOUS NERVE SUPPLY OF THE UPPER EXTREMITY

The **axillary artery** is divided into three parts by the Pectoralis minor muscle, the part above the muscle is called the first part, the part behind it is called the second part, and the part below it is called the third part. A branch from the outer cord joins one from the inner cord to make the median nerve. The outer cord gives off the external anterior thoracic and the musculo-cutaneous nerves. The inner cord gives off the ulnar, internal cutaneous, lesser internal cutaneous, and the internal anterior thoracic nerves. The posterior cord gives off the three subscapular and divides into the circumflex and musculo-spiral nerves. The musculo-spiral divides into the radial and posterior interosseous.

This plexus is situated in the posterior triangle of the neck between the Scalenus anticus and the Scalenus medius, being covered by the skin, Platysma myoides, and deep fascia; the posterior belly of the Omo-hyoid and the transversalis colli artery cross it. It next lies above and to the outer side of the subclavian artery; it passes behind the clavicle in the axilla where it first lies to the outer side of the first portion of the axillary artery, then its cords lie externally, internally, and posteriorly to the second part of the axillary artery. From the third part branches are given to the upper extremity.

The **clavicle** divides the brachial plexus into branches above it and branches below it. The branches above are communicating, muscular, posterior thoracic, and suprascapular.

The **communicating branches** are, (1) one from the fifth cervical or from the loop between the fifth and sixth cervical to the phrenic, which union takes place on the Scalenus anticus muscle. (2) A sympathetic connection.

The **muscular branches** are, (1) those to the Longus colli which come from the fifth, sixth, seventh, and eighth cervical before they enter into the brachial plexus. (2) Those to the Scaleni which also come from the fifth, sixth, seventh, and eighth cervical before they enter into the brachial plexus. (3) Those to the Rhomboidei, which come from the fifth cervical and pass through the Scalenus medius beneath the Levator anguli scapulae, which it sometimes supplies, to the Rhomboidei. (4) The nerve to the Subclavius which comes from the fifth and sometimes the sixth cervical. It often communicates with the phrenic.

The **posterior thoracic** or long thoracic (external respiratory of Bell) comes from the fifth, sixth, and seventh cervical. It is formed in the substance of the Scalenus medius, then passes behind the brachial plexus and axillary artery to supply the digitations of the Serratus magnus.

The **suprascapular** is formed by the fifth and sixth; it passes beneath the Trapezius and Omo-hyoid to pass through the suprascapular notch into the supraspinous fossa where it gives two branches to the Supraspinatus muscle and a branch to the shoulder-joint, then passes around the great scapular notch into the infraspinous fossa, giving two branches to the Infraspinatus muscle and one to the scapula itself.

All the other branches are below the clavicle.

The **external** or superficial anterior thoracic nerve comes from the outer cord just below the clavicle and its fibers may be traced to the fifth, sixth, and

seventh cervical nerves. It passes inward across the axillary vessels, pierces the costo-coracoid membrane and supplies the Pectoralis major. It communicates with the internal or deep anterior thoracic. This loop is around the front and inner side of the axillary artery and branches are often given from it to the Pectoralis major.

The **Internal** or deep anterior thoracic nerve comes from the inner cord and its fibers may be traced to the eighth cervical and first dorsal nerves. It passes between the axillary artery and vein, sometimes piercing the sheath of the vein. It gives a filament to a branch from the external or superficial anterior thoracic, then pierces the costo-coracoid membrane to supply the Pectoralis minor; after passing through the substance of this muscle it supplies the Pectoralis major.

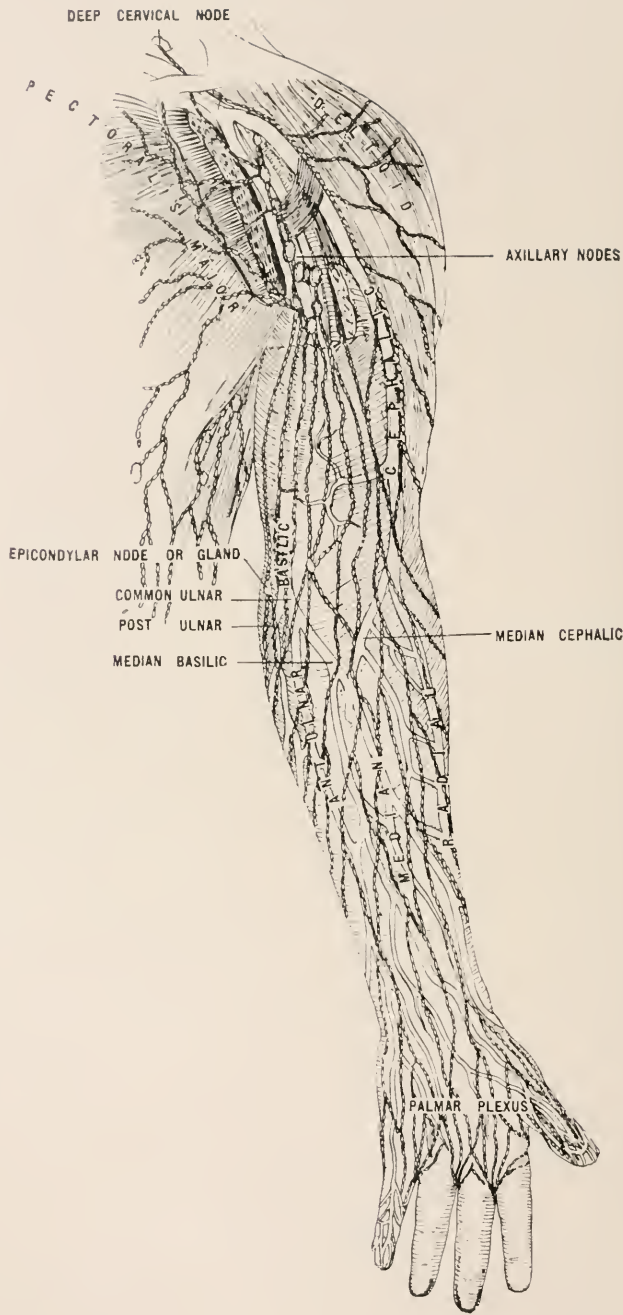
The **subscapular nerves** are three in number, the upper, the middle, and the lower. All are from the posterior cord, as a rule, although the upper one may come from the posterior branch of the first trunk before it enters into the posterior cord. The upper one may be traced to the fifth and sixth cervical; it supplies the Subscapularis muscle.

The **middle** or long subscapular may be traced to the seventh, occasionally to the fifth and sixth; it supplies the Latissimus dorsi. The lower one may be traced to the fifth and sixth cervical and supplies the axillary border of the Subscapularis and the Teres major. The Teres major may be supplied by a separate branch.

The **circumflex** comes from the posterior cord in common with the musculospiral. It is traced to the fifth, sixth, and seventh cervical nerves. It lies behind the third portion of the axillary artery where it passes downward and outward to the lower border of the Subscapularis muscle; it then passes through the quadrilateral space with the posterior circumflex artery. This space is bounded above by the Teres minor, below by the Teres major, on the outside by the Humerus, and on the inside by the long head of the Triceps. It gives an articular branch to the shoulder-joint which pierces the capsular ligament; it then divides into a superior and inferior branch. The superior branch winds around the surgical neck of the humerus with the posterior circumflex vessels, along the Deltoid to its anterior border, supplying the muscle and the integument over its lower part. The inferior branch supplies the Deltoid and Teres minor. The part supplying the Teres minor has a ganglion upon it. It then pierces the deep fascia to supply the integument on the lower two-thirds of the posterior surface of the Deltoid and the integument over the long head of the Triceps. A branch from the circumflex nerve supplies the long head of the *Biceps, the head of the humerus and the shoulder joint.

The **median nerve** is formed by a branch from the outer cord and one from the inner cord. Its fibers may be traced to the fifth, sixth, seventh and eighth cervical and first dorsal nerves. This junction takes place at the lower border of the Teres minor as a rule, although it may be almost to the elbow-joint. The branch from the inner cord crosses the third part of the axillary artery; the nerve lies then to the outer side of axillary artery, passing to the distal extremity of the arm to pass between the two heads of the Pronator radii teres. In the axilla it lies first to the outer side of the third part of the axillary artery, in the

*When the long head of the Biceps slips from its normal position it presses on this nerve and produces pain—"Glass arm." This can be cured osteopathically.



LYMPHATICS AND VEINS OF THE UPPER EXTREMITY—SUPERFICIAL

arm it lies to the side of the brachial artery and after crossing it to the inner side of the artery. It has no branches in the arm; at the elbow it gives off two articular branches to the joint.

After passing between the two heads of the Pronator radii teres it passes to the distal extremity of the forearm where it passes under the anterior annular ligament. In its course, in the forearm, it first lies between the Flexor sublimis digitorum and Flexor profundus digitorum, then between the tendons of the Flexor sublimis digitorum and Flexor longus pollicis. It supplies all the muscles in the first layer of the forearm except the Flexor carpi ulnaris, which are the Pronator radii teres, Flexor carpi radialis, and Palmaris longus; it also supplies the one muscle in the second layer which is the Flexor sublimis digitorum.

LESSON XXV.

The **anterior interosseous** nerve is given off just below and is accompanied by the anterior interosseous artery to the distal extremity of the forearm lying on the interosseous membrane. The nerve is external to the artery being between the Flexor profundus digitorum and Flexor longus pollicis. This branch supplies the Flexor longus pollicis, Pronator quadratus, and the outer side of the Flexor profundus digitorum. It sends a branch to the wrist-joint, also one to the anterior interosseous artery and to the interosseous membrane, to the medullary arteries and to the periosteum of the radius and ulna. It is worth while to note that the anterior interosseous nerve is a branch from the median, and the posterior interosseous nerve is a branch of the musculo-spiral nerve, while the anterior and posterior interosseous arteries are both branches of the same artery, viz., the common interosseous.

The palmar cutaneous branch of the median nerve arises in the distal third of the forearm, passes between the Flexor carpi radialis and Palmaris longus, pierces the deep fascia proximally to the anterior annular ligament and passes over that ligament to the integument and fascia on the palmar surface of the hand. It divides into two divisions, external and internal. The external one supplies the skin over the ball of the thumb and anastomoses with the anterior cutaneous branches of the musculo-spiral and radial nerves. The internal division supplies the integument on the palm, except that on the ulnar side and anastomoses with the palmar cutaneous branches of the ulnar nerve.

The **median nerve** then enters the hand beneath the anterior annular ligament. It spreads out and is of a reddish color. It divides into external and internal divisions. It lies upon the flexor tendons and is covered by integument, palmar fascia, and the superficial palmar arch. The external division supplies the Abductor pollicis, Opponens pollicis, and superficial head of the Flexor brevis pollicis, and occasionally the deep head of that muscle. The other muscles of the thumb are supplied by the ulnar. It then divides into first, second, and third digital branches for the thumb and index finger. The internal division gives off the fourth and fifth digital branches which supply the contiguous sides of the index and middle fingers and the middle and ring fingers; then there are five digital branches from the median nerve.

The **ulnar nerve** arises a little below the lower border of the Pectoralis minor, from the inner cord of the brachial plexus. Its fibers may be traced to the eighth cervical and first dorsal. It lies on the inner side of the axillary artery, also of brachial artery, until it passes below the insertion of the Coraco-brachialis where it forms an acute angle, and, in company with the posterior branch of the inferior profunda artery, pierces the internal intermuscular septum, then passing down to the groove between the internal condyle and the olecranon process it gives off two or three branches to the elbow-joint, then passes between the two heads of the Flexor carpi ulnaris in company with the posterior ulnar recurrent artery. In the forearm it lies between the Flexor profundus digitorum and Flexor carpi ulnaris; in the middle third of the forearm between the same two muscles with the Flexor sublimis digitorum on the other side. It is situated on the inner side of the ulnar artery and crosses the anterior annular ligament on the radial side of the pisiform. In the forearm it gives off branches near the elbow-joint which supply the Flexor carpi ulnaris and the inner part of the Flexor profundus digitorum.

The cutaneous branches arise about the middle of the forearm; there are two of these branches. The one most superficial pierces the deep fascia near the wrist to supply the integument and anastomose with the internal cutaneous. The other branch, which is the deeper one, is called the palmar cutaneous. It accompanies the ulnar artery, being upon its anterior surface, to the hand. The dorsal cutaneous arises about two or three inches from the wrist; it passes to the dorsal aspect of the wrist under the Flexor carpi ulnaris, superficial to the Extensor carpi ulnaris to supply the integument on the ulnar aspect of the dorsum of the hand and that of the little and half of the ring fingers.

The superficial terminal or palmar branch supplies the Palmaris brevis, the hypothenar eminence, the inner side of the little finger on its volar aspect, and the contiguous sides of the little and ring fingers. The deep palmar arch or branch passes between the Abductor minimi digiti and Flexor brevis minimi digiti, then through the Opponens minimi digiti to the deep surface of the flexor tendons and their synovial sheaths. It supplies the Abductor minimi digiti, Flexor brevis minimi digiti, Opponens minimi digiti, two inner Lumbricales, all the Interossei, Adductor transversus pollicis, Adductor obliquus pollicis, and inner head of the Flexor brevis pollicis and occasionally the outer head.

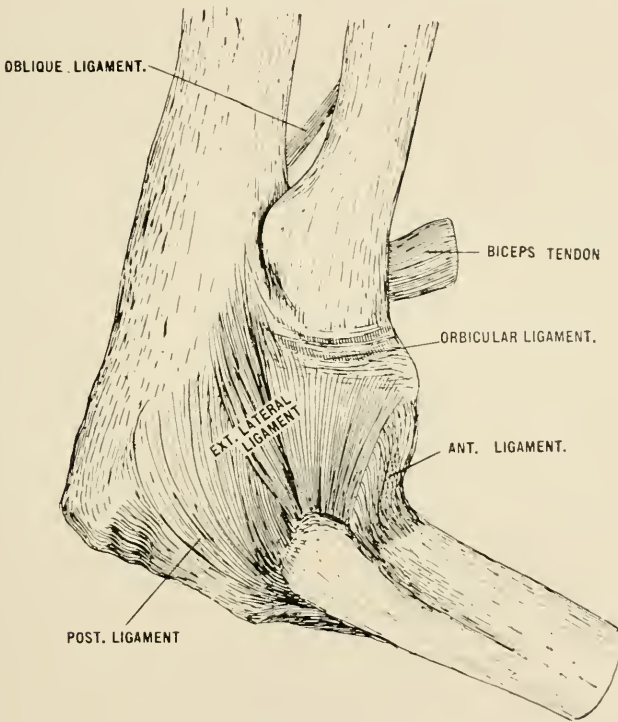
The ulnar nerve supplies eighteen muscles.

The **musculo-cutaneous** or external cutaneous (perforans Casserii) comes from the outer cord and its fibers may be traced to the fifth, sixth, and seventh cervical nerves. It supplies muscles in the arm but no integument, whereas it supplies integument in the forearm but no muscles. It begins opposite the lower border of the Pectoralis minor, passing outward and downward to pierce the Coraco-brachialis which it supplies. It divides in the substance of this muscle and passes to the outer side of the arm between the Biceps and the Brachialis anticus, supplying these muscles. It sends a branch with the nutrient artery into the bone. The branch to the Coraco-brachialis is given off from the nerve close to its origin. Occasionally this muscle is supplied by a separate branch from the outer cord. The branch to the Brachialis anticus

sends filaments to the elbow-joint. Near the outer border of the arm and a little above the tendon of the Biceps the nerve pierces the deep fascia, anastomosing with the proximal external cutaneous branch of the musculo-spiral, passing below the median cephalic vein where it divides into anterior and posterior. It then becomes cutaneous.

The anterior branch passes along the radial side of the forearm to supply the integument on the outer half of the anterior surface, ending in the thenar eminence. It anastomoses with the radial and the palmar cutaneous branch of

PLATE XXXVIII



THE ELBOW-JOINT—EXTERNAL VIEW

the median. It gives off an articular branch to the carpal bones which pierces the deep fascia to pass with the radial artery to the back of the wrist.

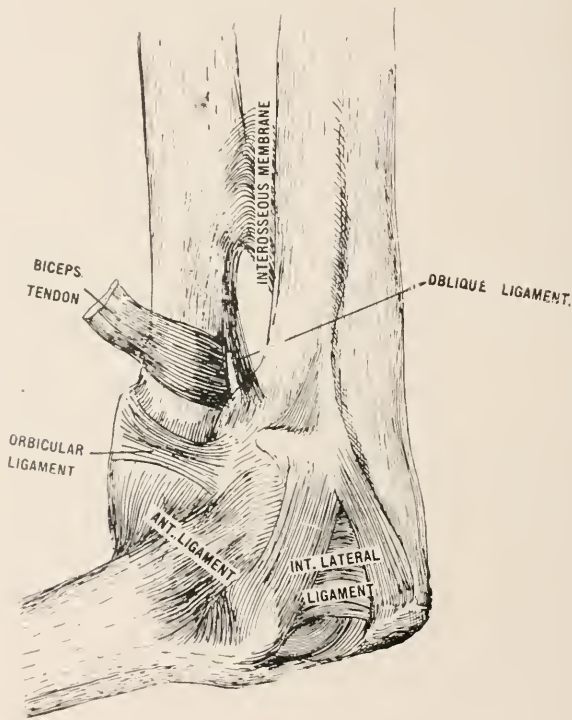
The posterior branch is smaller than the anterior one. It passes along the posterior aspect on the radial side of the forearm to the wrist. It anastomoses with the radial and the distal external cutaneous of the musculo-spiral.

LESSON XXVI.

The **musculo-spiral** is the largest branch of the brachial plexus. It and the circumflex are the terminal branches of the posterior cord. It supplies muscles and integument both above and below the elbow. Its fibers may be traced

to the fifth, sixth, seventh, and eighth cervical nerves and the first dorsal nerve. It commences at the lower border of the Pectoralis major. It first lies behind the third part of the axillary artery in front of the Subscapularis, Teres major, and Latissimus dorsi. After leaving the axilla it lies on the inner side of the upper one-third of the humerus behind the brachial artery and in front of the long head of the Triceps. It passes between the two humeral heads of the Triceps in the musculo-spiral groove in company with the superior profunda artery. This nerve and the anterior branch of the superior profunda artery perforate the external intermuscular septum and pass in the groove between the Supinator longus and Extensor carpi radialis longior on the outer side, and

PLATE XXXIX



THE ELBOW-JOINT—INTERNAL VIEW

the Brachialis anticus on the inner side. In the lower part of this groove it divides into the posterior interosseous and radial nerves. The musculo-spiral nerve supplies five muscles viz., Supinator longus, Extensor carpi radialis longior, Triceps, Brachialis anticus and Anconeus. If we substitute Anconeus for Deltoid we will have the five muscles attached to the external intermuscular septum. This nerve has muscular branches (just given), an articular branch, cutaneous branches and two terminal branches, viz., posterior interosseous and radial.

Its articular branch is given off from one of the branches to the Supinator longus, Extensor carpi radialis longior, or Brachialis anticus to the elbow-joint. Its cutaneous branches supply the integument of the arm over the musculo-spiral groove; in the forearm over the radial aspect of the dorsum of the forearm as far as the wrist. The internal cutaneous branch given off in the axilla crosses the tendon of the Latissimus dorsi, then passes behind the intercosto-humeral nerve, pierces the deep fascia to supply the integument on the middle of the back of the arm nearly to the olecranon. It gives off its upper and lower external cutaneous before it pierces the external intermuscular septum; the upper one perforates the outer head of the Triceps, accompanies the cephalic vein to the elbow and supplies the integument over the lower half of the outer and inner aspect of the arm. The lower one is the larger. It arises behind the external condyle to supply the integument on the lower part of the arm and radial aspect of posterior surface of forearm as far as the wrist. It anastomoses with the musculo-spiral and internal cutaneous.

The **radial nerve** is the smaller of the two terminal branches of the musculo-spiral and is purely cutaneous. It runs towards the wrist under the Supinator longus. It passes in front of the elbow, radial recurrent a., and Supinator brevis. In the middle third of the forearm it lies parallel to, and on the outer side of, the radial artery, superficial to the Pronator radii teres muscle. The nerve turns backward beneath the tendon of the Supinator longus and becomes cutaneous by piercing the deep fascia of the outer side of the forearm about three inches from its distal extremity; here it divides into two branches, external and internal. The external one supplies the integument on ball and outer border of thumb, anastomosing with the musculo-cutaneous. The inner one anastomoses with the musculo-cutaneous and dorsal branch of the ulnar, supplying integument on the dorsum of the hand and fingers in a manner somewhat similar to that of the median nerve on the palmar surface, the first branch to the inner side of the thumb, the second to the radial side of the index finger, the third to the adjacent sides of the index and middle fingers, and the fourth to the adjacent sides of the middle and ring fingers.

The **posterior-interosseous** nerve passes around the outer side of the proximal end of the radius, through the substance of the Supinator brevis to the back of the forearm, then passes between the superficial and deep layers to about the middle of the forearm where it passes beneath the Extensor longus pollicis to lie on the interosseous membrane on which it passes almost to the wrist in company with the posterior interosseous artery. At the distal extremity it accompanies the terminal branch of the anterior interosseous artery. It then passes through the fourth opening of the posterior annular ligament to the back of the wrist where it has a ganglion upon it, from which are given off its branches of distribution to the wrist-joint and carpal joints. It supplies all the muscles on the back of the forearm except the Anconeus. It supplies nine muscles in all, viz., Extensor communis digitorum, Extensor minimi digiti, Extensor carpi ulnaris, Supinator brevis, Extensor ossis metacarpi pollicis, Extensor longus pollicis, Extensor brevis pollicis, Extensor indicis, all of which

are on the back of the forearm, and Extensor carpi radialis brevior in the radial region.

The **internal cutaneous nerve** comes from the inner cord and its fibers may be traced to the eighth cervical and first dorsal nerves. The cutaneous branch perforates the deep fascia in the axilla to supply integument over the back of the arm nearly to the elbow. About half way along the inner side of the arm it pierces the deep fascia with the basilic vein, dividing into anterior and posterior branches. The anterior branch passes to the forearm either in front of, or behind the median basilic vein, supplies integument of the ulnar aspect of the anterior surface of the forearm as far as the wrist and communicates with the ulnar. The posterior branch passes in front of the internal condyle to the forearm where it supplies integument on the ulnar aspect of the dorsum of the forearm as far as the wrist. Above the elbow it anastomoses with the lesser internal cutaneous and at the wrist with the dorsal cutaneous of the ulnar.

The **lesser internal cutaneous** (nerve of Wrisberg) is the smallest branch of the brachial plexus. It comes from the inner cord and its fibers are traced to the first dorsal and sometimes the eight cervical in addition. In the axilla it communicates with the intercosto-humeral forming one or two loops. It is situated on the inner side of the axillary often being separated from the vein by the ulnar nerve. About the middle of the arm it pierces the deep fascia supplying integument over the olecranon.

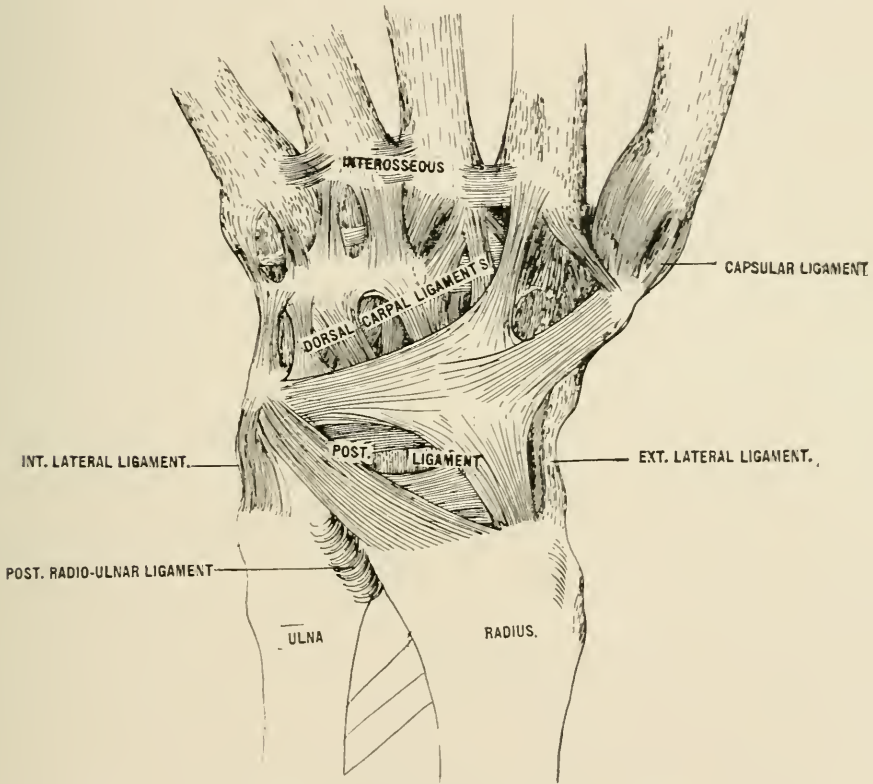
LESSON XXVII.

The hand.—(Plates XXVI-XXVII.)—There are twenty-seven bones in the hand while there are but twenty-six in the foot, there being one more bone in the carpus (wrist) than in the tarsus (ankle.) The number of muscles in the hand is twenty, the same as in the foot. There are also twenty muscles in the forearm. In the thumb (thenar eminence) there are five muscles, viz., Abductor pollicis, Opponens pollicis (Flexor ossis metacarpi pollicis,) Flexor brevis pollicis, Adductor obliquus pollicis, and Adductor transversus pollicis. The first two get the median nerve, the third one gets both the median and the ulnar nerves, while the last two get the ulnar. On the ulnar side of the hand there is the Palmaris brevis and the three muscles of the little finger (hypothenar eminence), viz., Abductor minimi digiti, Flexor brevis minimi digiti, and the Opponens minimi digiti (Flexor ossis metacarpi minimi digiti). All these are supplied by the ulnar nerve. In the middle palmar region there are four Lumbricales, four Dorsal interossei, and three Palmar interossei. The two outer Lumbricales are supplied by the median nerve, and the two inner ones and the seven Interossei by the ulnar nerve. The bones in the carpus are in two rows, those of the first row, beginning on the radial side are the scaphoid, semilunar, cuneiform, and pisiform, and those in the second row beginning on the radial side are the trapezium, trapezoid, os magnum, and unciform. The five beyond the carpus are called the metacarpals, and the fourteen in the fingers and thumb are the phalanges. Then the eight carpal, plus the five metacarpal, plus the fourteen phalanges, make the twenty-seven bones of the hand.

The scaphoid ossifies the sixth year. It articulates with five bones, viz., radius proximally, trapezium and trapezoid distally, and os magnum and semilunar internally. It has one muscle attached, the Abductor pollicis. The blood supply of the carpal bones is the anterior and posterior carpal arch, and a large branch from the anterior interosseous, and small branches from the posterior interosseous.

The semilunar ossifies the fourth year. It articulates with five bones, viz., radius proximally, os magnum and unciform distally, scaphoid and cuneiform

PLATE XL



THE WRIST-JOINT—POSTERIOR VIEW

on either side. It has no muscle attached. The blood supply is the same as the carpus.

The cuneiform ossifies the third year. It articulates with three bones, viz., semilunar externally, pisiform in front, and unciform distally, and with the triangular interarticular fibro-cartilage which separates it from the distal end of the ulna. There are no muscles attached to this bone.

The pisiform ossifies the twelfth year. It articulates with one bone, the cuneiform. It has two muscles attached, Flexor carpi ulnaris and Abductor minimi digiti.

carpi ulnaris, Flexor ossis metacarpi minimi digiti, and Flexor brevis minimi digiti.

Metacarpal bones.—(Plate VII.)—Each one has two centers, one for the shaft and one for the distal extremity, except the metacarpal of the thumb and it has one for the proximal extremity. The nucleus for the shaft appears about the eighth or tenth week of intrauterine life, and that for the diaphysis the third year, uniting with the shaft about the twentieth year. Each phalanx has two centers, one for the shaft which appears the eighth or tenth week, and one for the epiphysis between the third and fifth year, and joins the shaft the eighteenth year. The epiphysis for each phalanx is proximal, so the nutrient artery runs towards the distal end (Principle III, Lesson I). The center for the distal phalanx is at the distal extremity of the shaft, while that for the other phalanges is at the center of the shaft. The metacarpal of the thumb articulates with two bones, viz., trapezium proximally, and the first phalanx of the thumb distally. It has four muscles attached, Extensor ossis metacarpi pollicis, Flexor ossis metacarpi pollicis, Flexor brevis pollicis, and the First dorsal interosseous. The second metacarpal articulates with five bones, the trapezium, trapezoid, and os magnum proximally, the third metacarpal internally, and the first phalanx of the index finger distally. It has six muscles attached, the First and Second dorsal interossei, Extensor carpi radialis longior on the dorsal aspect of the bone and the Extensor carpi radialis, First palmar interosseous, and the Adductor obliquus pollicis on the palmar aspect of the bone. The third metacarpal articulates with four bones, os magnum proximally, the second metacarpal externally, the fourth metacarpal internally, and the first phalanx of the middle finger distally. It has six muscles attached; on the dorsal aspect the Second and Third dorsal interossei, and the Extensor carpi radialis brevis and on the palmar aspect the Adductor transversus pollicis, Adductor obliquus pollicis, and Flexor carpi radialis. The fourth metacarpal articulates with five bones, os magnum and unciform proximally, os magnum and third metacarpal externally, the fifth metacarpal internally and the first phalanx of the ring finger distally. It has three muscles attached; on the dorsal aspect the Third and Fourth dorsal interossei, and on the palmar aspect the Second palmar interosseous. The fifth metacarpal articulates with three bones, the unciform proximally, the unciform and fourth metacarpal externally, and the first phalanx of the little finger distally. It has five muscles attached; the Extensor carpi ulnaris, Flexor carpi ulnaris, Third palmar interosseous, Fourth dorsal interosseous, and Flexor ossis metacarpi minimi digiti.

Blood supply of the first metacarpal bone is derived from the princeps pollicis artery; it enters on the ulnar side, and is directed towards the head of the bone.

For the second metacarpal bone, the nutrient artery is derived from first palmar interosseous. It enters on the ulnar side, and is directed towards the proximal end or base of the bone.

For the third metacarpal bone the nutrient artery is derived from the interosseous; it enters as a rule, on the radial side and is directed towards the base.

For the fourth metacarpal bone the nutrient artery is furnished by the second interosseous; it enters on radial side of shaft, and is directed towards the proximal end.

For the fifth metacarpal bone the nutrient artery is derived from the third interosseous; it enters the shaft on the radial side, and is directed towards the proximal end. (Plate VII, page 33.)

LESSON XXVIII.

The first phalanx of the thumb articulates with two bones, the metacarpal of the thumb proximally, and the second phalanx distally. It has five muscles attached, the Abductor pollicis, Adductor obliquus, Adductor transversus pollicis, Extensor brevis pollicis, and the Flexor brevis pollicis. The second, or last phalanx of the thumb articulates with one bone, the first phalanx of the thumb. It has two muscles attached, the Extensor longus pollicis and the Flexor longus pollicis.

The first phalanx of the index finger articulates with two bones the second metacarpal proximally, and the second phalanx of the index finger distally. It has two muscles attached, the First dorsal interosseous, and the First palmar interosseous. The second phalanx of the index finger articulates with two bones, the first phalanx proximally, and the third phalanx distally. It has three muscles attached, the Extensor communis digitorum Extensor indicis, and the Flexor sublimis digitorum. The last phalanx of the index finger articulates with one bone, the second phalanx proximally. It has three muscles attached, the Extensor communis digitorum, Extensor indicis, and Flexor profundus digitorum. The first phalanx of the middle finger articulates with two bones, the metacarpal of the middle finger proximally, and the second phalanx of the middle finger distally. It has two muscles attached, the Second and Third dorsal interossei. The second phalanx of the middle finger articulates with two bones, the first phalanx proximally, and the third phalanx distally. It has two muscles attached, the Extensor communis digitorum and Flexor sublimis digitorum. The third phalanx articulates with one bone, the second phalanx proximally. It has two muscles attached, the Extensor communis digitorum and Flexor profundus digitorum.

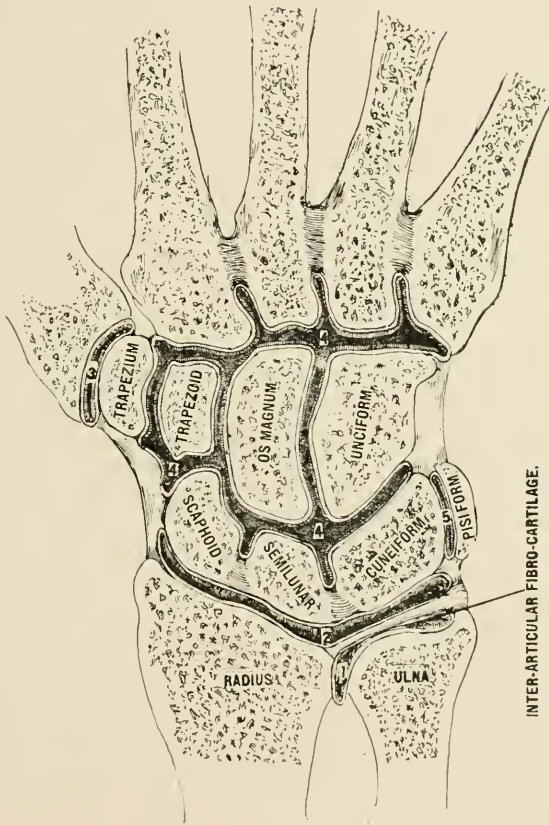
The first phalanx of the ring finger articulates with two bones, the fourth metacarpal proximally, and the second phalanx of the ring finger distally. It has two muscles attached, the Fourth dorsal interosseous and the Third palmar interosseous. The second phalanx of the ring finger articulates with two bones, the first phalanx of the ring finger proximally, and the third phalanx distally. It has two muscles attached, the Extensor communis digitorum and Flexor sublimis digitorum. The third phalanx of the ring finger articulates with one bone, the second phalanx proximally, and has two muscles attached, the Extensor communis digitorum and Flexor profundus digitorum.

The first phalanx of the little finger articulates with two bones, the fifth metacarpal proximally, and the second phalanx of the little finger distally. It has three muscles attached, the Extensor brevis minimi digiti, Abductor minimi

digiti, and the Third palmar interosseous. The second phalanx of the little finger articulates with two bones, the first phalanx proximally and the third phalanx distally. It has three muscles attached, the Extensor communis digitorum, Extensor minimi digiti, and Flexor sublimis digitorum. The third phalanx of the little finger articulates with one bone, the second phalanx proximally, and has three muscles attached, the Extensor communis digitorum, Extensor minimi digiti, and Flexor profundus digitorum.

Abductor pollicis.—DESCRIPTION.—(Plate XXXI.)—This is a thin, flat muscle placed immediately beneath the integument. It passes outward and

PLATE XLII



SHOWING THE SYNOVIAL MEMBRANES OF THE WRIST

downward and terminates in a flat tendon, sending a slip to join the tendon of the Extensor longus pollicis.

ORIGIN.—Ridge of trapezium and annular ligament. (Plate XXVII.)

INSERTION.—Radial side at base of first phalanx of thumb. (Plate XXVII.)

ACTION.—Abducts the thumb.

NERVE SUPPLY.—Sixth cervical through the median.

BLOOD SUPPLY.—From superficialis volae artery.

Opponens pollicis.—(Flexor ossis metacarpi pollicis.)—**DESCRIPTION.**—(Plate XXXI.)—This is a small triangular muscle placed beneath the preceding.

ORIGIN.—(Plate XXVI.)—Palmar surface of trapezium and annular ligament.

INSERTION.—Whole length of metacarpal of thumb on radial side. (Plate XXVI.)

ACTION.—Flexes metacarpal of thumb.

NERVE SUPPLY.—Sixth cervical through the median.

BLOOD SUPPLY.—From radial and superficialis volae arteries.

Flexor brevis pollicis.—**DESCRIPTION.**—(Plate XXXI.)—This muscle consists of two portions outer and inner, having separate origins and insertions. The outer portion is the more superficial and has a sesamoid bone developed in its tendon. The inner and deeper portion is very small.

ORIGIN.—(Outer portion) Trapezium and outer two-thirds of annular ligament. (Inner portion) Ulnar side of first metacarpal bone. (Plate XXVIII.)

INSERTION.—Both sides of base of first phalanx of thumb by two tendons. (Plate XXVII.)

ACTION.—Flexes thumb.

NERVE SUPPLY.—Outer portion, sixth cervical through median; inner portion, eighth cervical through ulnar.

BLOOD SUPPLY.—From radial artery.

Adductor obliquus pollicis.—**DESCRIPTION.**—(Plate XXXI.)—This muscle arises by several slips. The greater number of fibers pass obliquely downward and converge to a tendon which unites with the tendons of the deeper portion of the Flexor brevis and Adductor transversus pollicis, a sesamoid bone being developed in the tendon of insertion. A considerable fasciculus passes obliquely outward beneath the tendon of the long flexors to join the superficial portion of the short flexor and the Abductor pollicis. This muscle was formerly described as the deep portion of the Flexor brevis pollicis.

ORIGIN.—(1) Os magnum; (2) bases of second and third metacarpal bones; (3) anterior carpal ligaments; (4) sheath of tendon of Flexor carpi radialis. (Plate XXVII.)

INSERTION.—Inner side of base of first phalanx of thumb. (Plate XXVII.)

ACTION.—Moves thumb inward toward index finger.

NERVE SUPPLY.—Eighth cervical through ulnar.

BLOOD SUPPLY.—From the palmar arches.

Adductor transversus pollicis.—**DESCRIPTION.**—(Plate XXXI.)—This is the most deeply seated of this group of muscles; it is triangular in form, arising by its broad base. The fibers converge toward their insertion which is in common with the inner part of the Flexor brevis pollicis and the Adductor obliquus pollicis. From this common tendon a slip is prolonged to the Extensor longus pollicis.

ORIGIN.—Lower two-thirds of metacarpal of middle finger on palmar surface. (Plate XXVII.)

INSERTION.—Ulnar side of base of first phalanx of thumb by common tendon. (Plate XXVII.)

ACTION.—Draws thumb towards median line.

NERVE SUPPLY.—Eighth cervical through ulnar.

BLOOD SUPPLY.—From the palmar arches.

LESSON XXIX.

Palmaris brevis.—**DESCRIPTION.**—(Plate XXXI.)—This is a thin, quadrilateral muscle placed beneath the integument on the ulnar side of the hand. The palmar fascia is in relation with its deep surface and separates it from the ulnar vessels and nerve.

ORIGIN.—Annular ligament by tendinous fasciculi and palmar fascia.

INSERTION.—Skin on inner border of palm. (Plate XXXI.)

ACTION.—Corrugates skin of hand.

NERVE SUPPLY.—Eighth cervical through the ulnar.

BLOOD SUPPLY.—The ulnar artery.

Abductor minimi digiti.—**DESCRIPTION.**—(Plate XXXI.)—This muscle is situated on the ulnar border of the palm of the hand.

ORIGIN.—Pisiform bone and from the tendon of the Flexor carpi ulnaris.

INSERTION.—By two slips, the one into ulnar side of base of first phalanx of little finger; the other into ulnar border of the aponeurosis of the Extensor minimi digiti. (Plate XXVII.)

ACTION.—Abducts little finger from middle line of hand.

NERVE SUPPLY.—Eighth cervical through the ulnar.

BLOOD SUPPLY.—The ulnar artery.

Flexor brevis minimi digiti.—**DESCRIPTION.**—(Plate XXXI-XXVII.)—The Flexor brevis minimi digiti lies on the same plane as the preceding muscle, on its radial side. It is separated from the Abductor at its origin by the deep branches of the ulnar artery and nerve. This muscle is sometimes wanting; the Abductor is then usually of large size.

ORIGIN.—From the convex aspect of the hook of the unciform bone and anterior surface of annular ligament.

INSERTION.—Inner side of base of first phalanx of little finger.

ACTION.—Flexes little finger.

NERVE SUPPLY.—Eighth cervical through the ulnar.

BLOOD SUPPLY.—The ulnar artery.

Opponens minimi digiti (Flexor ossis metacarpi minimi digiti).—**DESCRIPTION.**—(Plate XXXI.)—This is a triangular muscle placed immediately beneath the preceding.

ORIGIN.—From convexity of hook of unciform bone and contiguous portion of annular ligament. (Plate XXVII.)

INSERTION.—Whole length of metacarpal of little finger along ulnar margin. (Plate XXVII.)

ACTION.—Draws fifth metacarpal forward so as to deepen hollow of palm.

NERVE SUPPLY.—Eighth cervical through ulnar.

BLOOD SUPPLY.—Ulnar artery.

Lumbricales.—**DESCRIPTION.**—(Plate XXXI.)—The lumbricales are four small fleshy fasciculi, accessories to the deep Flexor muscle.

ORIGIN.—Tendons of deep flexor. (Plate XXXI.)

INSERTION.—Tendinous expansion from Extensor communis digitorum on back of each finger.

ACTION.—To flex first phalanges.

NERVE SUPPLY.—The two outer Lumbricales by the sixth cervical through the third and fourth digital branches of the median; the two inner by the eighth cervical through deep palmar branch of ulnar. The third lumbrical receives the median in almost half the cases.

BLOOD SUPPLY.—From digital branches of the superficial palmar arch and the interosseous branches of the deep palmar arch.

Dorsal interossei.—DESCRIPTION.—(Plates XXXIV-XXXIII.)—These small muscles, four in number, occupy the intervals between the metacarpal bones. They are bipenniform. Between the double origin of each is a narrow triangular interval, through the first of which passes the radial artery; through each of the outer three passes a perforating branch from the deep palmar arch.

The Abductor indicis or the First dorsal interosseous is the largest of these muscles.

ORIGIN.—by two heads; (1) Outer head from upper half of ulnar border of first metacarpal bone, (2) Inner head from almost the whole length of the radial border of the second metacarpal bone. (Plate XXVI.)

INSERTION.—Into the radial side of base of first phalanx of index finger. The Second dorsal interosseous.

ORIGIN.—By two heads from the adjacent sides of the second and third metacarpal. (Plate XXVI.)

INSERTION into the radial side of the first phalanx of middle finger. The Third dorsal interosseous.

ORIGIN.—By two heads from the adjacent sides of the third and fourth metacarpal bones. (Plate XXVI.)

INSERTION.—Into the ulnar side of the first phalanx of middle finger. The Fourth dorsal interosseous.

ORIGIN.—By two heads from the adjacent sides of the fourth and fifth metacarpal bones. (Plate XXVI.)

INSERTION.—Into the ulnar side of the first phalanx of ring finger.

ACTION.—(1) Extend the last two phalanges, (2) Flex the metacarpophalangeal joints, (3) Abduct the fingers.

BLOOD SUPPLY.—From deep palmar and posterior carpal arches.

NERVE SUPPLY.—Deep branches of the ulnar nerve.

The **Palmar interossei** which are placed on the palmar surface of the second, fourth and fifth metacarpal bones are three in number. Their insertion besides being into the bone is into the aponeurotic expansion of the common tendon of the same finger, the same as the dorsal interossei. (Plate XXXV.)

First palmar interosseous.

ORIGIN.—By one head from the ulnar side of the second metacarpal bone.

INSERTION.—Into the ulnar side of the first phalanx of index finger.

Second palmar interosseous.

ORIGIN.—By one head from the radial side of the fourth metacarpal bone.

INSERTION.—Into the radial side of the first phalanx of ring finger.
Third palmar interosseous.

ORIGIN.—By one head from the radial side of the fifth metacarpal bone.

INSERTION.—Into the radial side of the first phalanx of little finger.

Each finger has two Interossei muscles except the little finger. The Abductor minimi digiti takes the place of one of the pair.

NERVE SUPPLY.—Ulnar.

BLOOD SUPPLY.—Deep palmar arch.

ACTION.—Same as the Dorsal interossei, but these adduct instead of abduct.

LESSON XXX.

Fascia of the arm.—Just beneath the skin is the superficial fascia which has two layers, a superficial one consisting mainly of adipose tissue, and a deep one which is fibrous in structure and is in contact with the deep fascia. The superficial nerves, vessels and lymphatics lie between these two layers.

The deep fascia of the arm forms a sleeve which encloses the muscles and most of the vessels and nerves. It is continuous with the fascia of the chest, back, shoulder above by being attached to the clavicle, the scapula and the spine, and to that of the forearm by being attached to the condyles of the humerus and olecranon of the ulna. It is thin over the Biceps, thick over the Triceps; strengthened on the inner side by fibers from the tendon of the Pectoralis major and Latissimus dorsi, on the outer side by fibers from the tendon of the Deltoid; the axillary fascia is also continuous with it. The **external intermuscular septum** extending from the insertion of the Deltoid to the External condyle and attached to the superior condylar ridge joins the inner surface of the deep fascia, thus dividing the sleeve or cylinder of fascia into an anterior and posterior compartment, the anterior one having flexor muscles in it and the the posterior one extensor muscles. This septum is pierced by the musculospiral nerve and superior profunda artery from behind forward. It has five muscles attached to it, viz., Deltoid, Brachialis anticus, Triceps, Supinator longus, and Extensor carpi radialis longior. In these five muscles if we substitute the Deltoid for Anconeus we will have the five muscles supplied by the musculospiral nerve.

The **internal intermuscular septum** is thicker than the external one; it extends from the insertion of the Coraco-brachialis to the internal condyle of the humerus, being attached to the supracondylar ridge to the inner surface of the sleeve of fascia of the forearm. It also divides the muscles into an anterior and posterior division. It has three muscles attached to it, viz., the Triceps, Brachialis anticus, and Coraco-brachialis, and occasionally the Pronator radii teres. If we substitute the Triceps for Biceps in this group of muscles we will have the muscles supplied by the musculocutaneous nerve. The basilic vein pierces the deep fascia at the junction of the lower third with the middle third of the humerus.

The **deep fascia of the forearm** is continuous with that of the arm at the elbow and with that of the hand at the wrist. It passes over the anterior an-

nular ligament which is in reality the aponeurosis which separates the first and second layers of the muscles of the forearm. It passes from the pisiform bone and ulnar process to the scaphoid and trapezium; it is a strong fibrous band. At the posterior aspect it is thickest where it is attached to the sides of the triangular posterior surface of the olecranon and to all of the posterior ridge of the ulna. It receives a band from the bicipital fascia below the internal condyle in front, and an aponeurosis from the insertion of the Triceps behind. It is pierced by a communicating vein at the cubital fossa.

The **posterior annular ligament** is strengthened by transverse fibers and passes from the outer border of the lower end of the radius across to the inner side of the pisiform and ulnar bones, its inner surface being attached to the ridge on the posterior surface of the radius. It makes six canals for the passage of the extensor tendons; the first canal has the Extensor ossis metacarpi pollicis and Extensor brevis pollicis; the second the Extensor carpi radialis longior and Extensor carpi radialis brevior; the third the Extensor longus pollicis; the fourth the Extensor communis digitorum, which is in the superficial layer, and the Extensor indicis, which is in the deep layer; the fifth, the Extensor minimi digiti which is in the superficial layer; the sixth, the Extensor carpi ulnaris which, is in the superficial layer.

The **anterior annular ligament** has nine muscles attached to it, all those of the thumb except the Adductor transversus pollicis, and all those of the little finger except the Abductor minimi digiti; then there are four of the thumb and two of the little finger, making six; besides these six it has the Flexor carpi ulnaris, Palmaris longus, and Palmaris brevis, making the nine. The tendon of the Flexor carpi radialis pierces the anterior annular ligament and the Palmaris longus passes over it, but is also attached to it. The median nerve and the tendons of three muscles pass under it; the muscles are the Flexor sublimis digitorum, Flexor profundus digitorum, and Flexor longus pollicis.

Fascia of the hand.—The fascia on the back of the hand is thin and is composed mostly of transverse fibers. This fascia is a continuation of the posterior annular ligament. It connects the extensor tendons together on the back of the hand. Between the fingers it dips down to join the web which connects the bases of the fingers. The deep layer is attached to the back of the metacarpals and covers the Dorsal interossei.

Palmar Fascia.—The deep palmar fascia consists of strong fibrous tissue covering the palmar surface of the hand. It is for the most part formed by the expansion of the tendons of the Palmaris longus. It is also continuous with the anterior annular ligament proximally. It has a central and two lateral portions. The central portion is triangular with the apex towards the wrist and base towards the fingers. The superficial part is formed by longitudinal fibers and the deep part by transverse fibers. Its base is divided into four processes which join the ligamenta vaginalia of the finger tendons. (Plates XXIX-XXXI.)

Ligamenta vaginalia are fibrous sheaths or theca over the flexor tendons. They are so attached to the phalanges as to form osseo-aponeurotic canals. These sheaths are strong opposite the middle of the first and second phalanges,

but much thinner opposite the joints. Each sheath is lined by a synovial membrane, which is reflected upon the tendons. The synovial sheaths for the tendons of the thumb and little finger are continuous with the two synovial bursæ beneath the anterior annular ligament, but those for the intervening digits terminate in a sac near the metacarpo-phalangeal articulation. The outer portion (thenar fascia) covers the ball of the thumb. Proximally it is attached to the anterior annular ligament, the tendons of the *Palmaris brevis* and aponeurosis from the tendons of the *Extensor ossis metacarpi pollicis*. It continues distally with the ligamenta vaginalia of the *Flexor longus pollicis*. The inner portion or hypothenar fascia, is triangular with the apex proximally and attached to the anterior annular ligament and deep fascia of the forearm at the inner side of the wrist; distally it is covered above by the *Palmaris brevis*. (Plate XXX.)

LESSON XXXI.

Besides the arterial, venous and capillary circulation there is a lymphatic circulation extending over the body by beginning in microscopical spaces and extending until they form lymphatic vessels. These vessels are enlarged by receiving radicles or tributaries in a like manner to the veins. Along the course of the lymphatic vessels are lymphatic nodes, sometimes called glands. There are in the neighborhood of seven hundred of these nodes. They are situated principally in the abdominal and thoracic cavities. In the upper extremity they are found no farther than the elbow. In the lower extremity they are found no farther than the popliteal space, as a rule; however, a few may be found on the anterior tibial artery. These nodes manufacture the white blood corpuscles. There are four other places in the body where they are manufactured, viz., spleen, thymus gland, thyroid gland and the red marrow of bones.

The **lymph** of all the body, except the right side of the head, the right side of the thorax, the right arm, and the upper surface of the liver collects into a large duct, the left lymphatic or thoracic duct. It is called thoracic duct because it passes through the thorax. It is about fifteen or eighteen inches long. It begins in front of the second lumbar vertebra where it is enlarged (receptaculum chyli) and extends through the thorax, through the superior opening of the thorax, and empties into the left subclavian or innominate vein.

The heart is the main factor in the circulation of the lymph. The other factors will be learned in physiology. The lymphatic vessels and nodes, like the veins of the arm, are in two sets, a superficial and deep set. After the blood has passed through the arteries and capillaries, nourishing the various parts, it comes back by means of the veins.

The **superficial veins** of the distal extremity receive the name radial, anterior and posterior ulnar, and median. They lie between the two layers of the superficial fascia. (Plate XXXVII.)

The anterior ulnar is formed by a network of veins at the anterior and ulnar side of the hand and wrist. It extends on this aspect of the forearm to the bend of the elbow where it joins the posterior ulnar to form the common ulnar.

The posterior ulnar begins at the ulnar aspect of the wrist, from which it passes to the bend of the elbow to join the anterior ulnar.

The common ulnar runs upward and outward to join the median basilic to form the basilic, which pierces the deep fascia in the inner side and below the middle of the forearm to ascend with the brachial artery and continues as the axillary vein. At times the common ulnar is absent, the anterior and posterior ulnar joining the median basilic separately.

The median vein is formed on the palmar surface of the hand and passes to the bend of the elbow where it divides into two branches, median basilic and median cephalic. It communicates with the *venæ comites* of the ulnar before it reaches the elbow. This communicating link is called the deep median vein.

The radial begins on the dorsum of the thumb and radial aspect of the hand; it passes to the elbow-joint where it joins the median cephalic forming the cephalic.

The cephalic vein passes on the outer side of the Biceps to the groove between the Deltoid and the Pectoralis major; it perforates the deep fascia and the costo-coracoid membrane to end in the axillary vein below the clavicle. It occasionally connects with the external jugular or subclavian by a branch in front of the clavicle called the jugular cephalic.

The **deep veins** of the upper extremity accompany the arteries; they are called *venæ comites* and are connected along their course by transverse branches. The digital arteries have *venæ comites* which unite at the base of the fingers to end in *venæ comites* of the superficial palmar arch. Those of the radial side accompany the superficialis volæ, while those of the ulnar side end in the deep ulnar veins. The *venæ comites* of the ulnar and radial unite to form the brachial *venæ comites*. The *venæ comites* of the anterior and posterior interosseous unite at the proximal extremity of the forearm, ending in the ulnar *venæ comites*. The deep palmar *venæ comites* empty into the radial externally and the ulnar internally. The brachial *venæ comites* are formed by those of the forearm; they accompany the artery and empty into the axillary just above the lower border of the tendon of the Latissimus dorsi.

The **axillary vein** is a continuation of the basilic. It accompanies the axillary artery and becomes the subclavian vein at the upper extremity of the axilla. It has a pair of valves opposite the lower border of the Subscapularis. It receives radicles corresponding to the branches of the axillary artery. It also receives the cephalic vein.

The **axilla** is the anatomical space through which passes the brachial plexus and the axillary vessels. It is filled with lymphatic vessels and nodes and areolar tissue. It is pyramidal in shape, having four sides, a base, and an apex. The apex corresponds to a point between the clavicle, the upper part of the scapula and the first rib. The base is the arm-pit which is made by fascia passing from the lower borders of the Latissimus dorsi behind and the Pectoralis major in front. The anterior margin of the base is higher than the posterior margin. This space is narrow externally, but broad internally.

Its boundaries are as follows: Plate XVI.

IN FRONT:—(1) Pectoralis major, (2) Pectoralis minor.

BEHIND:—(1) Subscapularis (above,) (2) Teres major and (3) Latissimus dorsi (below.)

OUTER SIDE:—(1) Humerus, (2) Biceps, (3) Coraco-brachialis.

INNER SIDE:—(1) First four ribs and their intercostal spaces, (2) a part of the Serratus magnus.

The axillary vessels, brachial plexus, branches of the intercostal nerves, lymphatic nodes, all connected by areolar tissue and fat lie in this space.

In **finishing the arm** it is well to review the cutaneous nerve supply of the hand which is as follows: Plate XXXVI.

All the integument on the ulnar side of the middle line of the ring finger on both palmar and dorsal surfaces of the hand is supplied by the ulnar nerve. THIS LINE ON THE DORSUM OF THE HAND MAY BE DRAWN THROUGH THE MIDDLE OF THE MIDDLE FINGER INSTEAD OF THE RING FINGER. All on the radial side of this line on palmar surface is supplied by the median, on the dorsal surface by the radial. The radial nerve extends to the base of the thumb nail, to the distal interphalangeal joint of index finger and not quite to the proximal interphalangeal joint of middle finger, and sends a few twigs to the skin of the metacarpal articulation of ring finger. The parts of the dorsal of the thumb, index, middle and ring fingers not supplied by the radial get the median.

The synovial membrane of the wrist (Plate XLII.) **This membrane** consists of five portions. **FIRST PORTION** is called MEMBRANA SACCIFORMIS and is between the interarticular fibro-cartilage and the ulna, also extending between the radius and ulna. **THE SECOND PORTION** is between the radius and interarticular fibro-cartilage proximally and the scaphoid, semilunar and cuneiform distally. **THE THIRD PORTION** is between the trapezium and metacarpal of the thumb. **THE FOURTH PORTION** is large and extends between the scaphoid, semilunar and cuneiform proximally and after sending septa between the bones of the second row of the wrist ends by separating this second row from the second, third, fourth and fifth metacarpal bones distally. It also sends projections between the metacarpal bones just mentioned. **THE FIFTH PORTION** is between the cuneiform and pisiform bones.

REVIEW QUESTIONS.

1. Define Anatomy.
2. Define each of its nine divisions.
3. Give three definitions for Aponeurosis.
4. What is a tendon?
5. Give two definitions for Sinus.
6. Define Apophysis.
7. Define Epiphysis.
8. Which way do the nutrient arteries run in the bones of the arm?
9. Which way do the nutrient arteries run in the bones of the leg?
10. Give four rules for Epiphysis.
11. Give functions of Periosteum.
12. How does a long bone grow in length, also in thickness?
13. Name the ninety long bones.
14. Name the forty flat bones.
15. Name the forty irregular bones.
16. Name the thirty short bones.
17. Name eight eminences on bones.
18. Name fourteen prominences on bones.
19. Name five articular cavities in bones.
20. Name ten non-articular cavities in bones.
21. Name the bones of the body and tell what each means.
22. Now many muscles in the body?
23. Name six ways in which muscles take their names.
24. What is the origin of a muscle?
25. What is the insertion of a muscle?
26. Give parts that make a joint.
27. Give Hilton's law.
28. Give all subdivisions of SYNARTHROSIS and an example of each.
29. Same of AMPHIARTHROSIS.
30. Same of DIARTHROSIS.
31. How do ligaments take their names?
32. What is a muscular nerve?
33. What is a cutaneous nerve?
34. What is a musculo-cutaneous nerve?
35. Give five principles concerning nerve roots and their branches.
36. Give definition for nerve center.
37. Give name, distribution, function and method of exit of the 1st cranial nerve.
38. Same of 2nd cranial nerve.
39. Same of 3rd cranial nerve.
40. Same of 4th cranial nerve.
41. Same of 5th cranial nerve.
42. Same of 6th cranial nerve.

43. Same of 7th cranial nerve.
44. Same of 8th cranial nerve.
45. Same of 9th cranial nerve.
46. Same of 10th cranial nerve.
47. Same of 11th cranial nerve.
48. Same of 12th cranial nerve.
49. What is the lesser circulation of the blood?
50. What is the greater circulation of the blood?
51. Who demonstrated the circulation of the blood?
52. Where is the purest blood in the body found?
53. What kind of muscle is the heart?
54. Capillaries are not found in what structures?
55. Which are the larger, arteries or veins?
56. What do you understand by anastomosis?
57. Give rule for arteries and veins above and below the diaphragm.
58. Name some of the veins that do not have valves.
59. Trace the fetal circulation.
60. Name the things obliterated at birth in the fetal circulation.
61. The eight cervical nerves leave the spinal cord above the spinous process of what cervical vertebra?
62. The first six dorsal nerves leave the spinal cord between the spinous processes of what vertebræ?
63. The lower six dorsal nerves leave the spinal cord between the spinous processes of what vertebræ?
64. The five lumbar nerves leave the spinal cord between the spinous processes of what vertebræ?
65. The five sacral nerves leave the spinal cord between the spinous processes of what vertebræ?
66. Bound the Axilla.
67. Bound the Quadrilateral Space.
68. What pierces the Costo-coracoid Membrane?
69. Describe the Costo-coracoid Membrane.
70. What structures lie in the Axilla?
71. What structures pass through the Quadrilateral Space?
72. What nerves branch from each cord of the Brachial Plexus?
73. What and how many muscles are supplied by the musculo-cutaneous?
74. What and how many muscles are supplied by the median?
75. What and how many muscles are supplied by the circumflex?
76. What and how many muscles are supplied by the musculo-spiral?
77. What and how many muscles are supplied by the ulnar?
78. What and how many muscles are supplied by the Subscapular nerves?
79. The Rhomboid nerves come from which one?
80. The Posterior Thoracic comes from which ones?
81. What is another name for this nerve?
82. The Supra-scapular comes from which ones?

83. Give the nerve supply of integument of hand.
84. Give the nerve supply of Lumbricales.
85. Give the nerve supply of Interossei.
86. Group the muscles on forearm; give nerve supply.
87. What muscles are attached to the External Lateral Ligament?
88. What muscles are attached to the Internal Intermuscular Septum?
89. What muscles are attached to the External Intermuscular Septum?
90. What three muscles are attached to the Common Aponeurosis?
91. What passes under the Anterior Annular Ligament?
92. What passes through the Anterior Annular Ligament?
94. What muscles are attached to Anterior Annular Ligament?
95. What muscles pass through the six openings in Posterior Annular Ligament?
96. Give the three divisions of Axillary Artery.
97. Give the relations of the first part of Axillary Artery.
98. Give the relations of the second part of Axillary Artery.
99. Give the relations of the third part of Axillary Artery.
100. Give the branches of each part of Axillary artery.
101. Give relations of Brachial Artery.
102. Name the branches of Brachial Artery.
103. Give the relations of Radial Artery.
104. Name the branches of the Radial Artery.
105. Give relations of Ulnar Artery.
106. Give the branches of Ulnar Artery.
107. Give relations of Superficial Palmar Arch.
108. What pierces the Coraco-brachialis?
109. What passes between the two heads of the Pronator radii teres?
110. What passes between the two heads of Flexor carpi ulnaris?
111. What pierces the Internal intermuscular septum?
112. What pierces the External intermuscular septum?
113. Describe the Cubital fossa?
114. What passes through the Cubital fossa?
115. Name the bones of the Carpus.
116. Give articulation of each bone.
117. Which ones have muscles attached to them?
118. What muscles are attached to the Trapezium?
119. What muscles are attached to the Os magnum?
120. What muscles are attached to the Unciform?
121. What muscles are attached to the Pisiform?
122. What muscles are attached to the Metacarpal (each bone)?
123. What muscles are attached to the Phalanges of the thumb?
124. What muscles are attached to the Phalanges of the fingers?
125. How many bones in the hand?
126. Give ligaments of clavicle.
127. Give ligaments of scapula.
128. Give ligaments of shoulder.

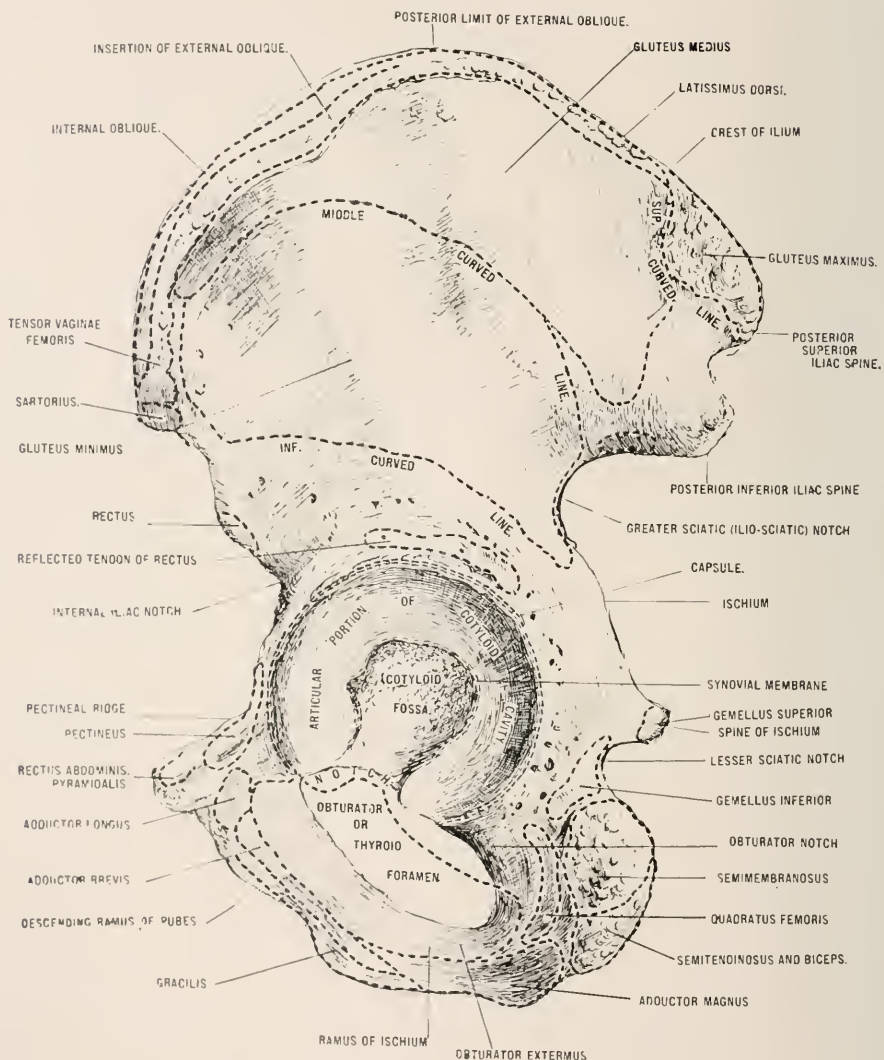
129. Give ligaments of elbow.
130. Give ligaments of forearm.
131. Give ligaments of wrist.
132. What kind of joint is Sterno-clavicular?
133. What kind of joint is Acromio-clavicular?
134. What kind of joint is the shoulder?
135. What kind of joint is the elbow?
136. What kind of joint is the wrist?
137. From what do cords of Brachial plexus take their names?
138. What converts the Supra-scapular notch into a foramen?
139. What vessels pass above the Transverse ligament?
140. What structure passes below the Transverse ligament?
141. What structures go through the Musculo-spiral groove?
142. What holds the arm in position?
143. What forms the Superficial palmar arch?
144. What forms the deep palmar arch?
145. Give the Anastomosis of elbow-joint.
146. How many muscles are attached to the clavicle?
147. How many muscles are attached to the scapula?
148. How many muscles are attached to the humerus?
149. How many muscles are attached to the ulna?
150. How many muscles are attached to the radius?
151. Name the muscles lacking origin or insertion into bone.
152. Describe the deep fascia of arm.
153. Describe the deep fascia of forearm.
154. Describe the Anterior and Posterior Annular ligaments.
155. Describe synovial membranes of wrist.
156. Name principal Flexor and Extensor muscles of hand.
157. What muscles are attached to the greater tuberosity?
158. What muscle is attached to the lesser tuberosity?
159. The pulse is felt between what two tendons?
160. How does the radial artery get into the palm of the hand?
161. How many muscles from elbow to wrist?
162. What nerve lies in the substance of the Supinator brevis?
163. Pronators and flexors are attached to which condyle of humerus?
164. Extensors and supinators to which condyle?
165. What muscles attached to external or anterior bicipital ridge?
166. To the posterior or internal bicipital ridge?
167. What one is inserted in the groove?
168. The Musculo-spiral nerve divides into what branches?
169. What kind of nerve is the radial?
170. Give Anterior carpal arch.
171. Give Posterior carpal arch.
172. How does the posterior interosseous artery get to the back of the forearm?
173. How many muscles in the hand?

174. What relation does the posterior interosseous artery bear to the deep layer of muscles of the forearm?

175. Describe the humerus.

176. With what does it articulate?

PLATE XLIII.



EXTERNAL VIEW OF LEFT INNOMINATE BONE.

177. How many and what muscles attached to humerus, ulna and radius?

178. What is the longest muscle inserted on the humerus?

179. What muscles have attachment to both ulna and radius?

180. With how many bones does the radius articulate?

181. With how many bones does the ulna articulate?

182. What are the two principal veins of the arm?
183. Which one passes through the Axilla?
184. What veins form each?
185. What is the longest nerve in the arm?
186. How many openings in the capsular ligament of the shoulder-joint?
187. Where are the greater and lesser sigmoid cavities?
188. With what does each articulate?
189. Why is the cephalic vein so called?
190. Why are the Lymphatics so called?
191. What is lymph?
192. What else are lymphatics called?
193. What does the lymphatic system include?
194. Over how much of the body does it extend?
195. How many coats have the lymphatics?
196. The lymphatic glands of the arm are divided into how many sets?
197. The lymphatic vessels are how divided?
198. Give blood supply and ossification of clavicle.
199. The same of Scapula.
200. The same of Humerus.
201. The same of Radius.
202. The same of Ulna.
203. The same of Carpus.
204. The same of Metacarpus.
205. The same of Phalanges.
206. What is the largest nerve of Brachial plexus?
207. What separates median basilic vein from brachial artery?
208. Give another name for Supinator longus.
209. Give another name for Extensor brevis pollicis.
210. Give another name for Extensor longus pollicis.
211. Give another name for First dorsal interosseous.
212. Give Acromial rete.
213. Deep branch of ulna passes between what muscles?
214. Give another name for lesser internal cutaneous nerve.
215. Give another name for the long thoracic artery.
216. On which side of the pisiform bone does the ulnar artery cross the anterior annular ligament?

LESSON XXXII.

THE ILIUM. (Plates XLIII-XLIV.)

The **ilium** which forms less than two-fifths of the acetabulum is the superior expanded portion of the innominate bone. This portion is limited superiorly by the arched crest of the ilium, but anteriorly and posteriorly by margins which diverge at right angles from each other. The crest is concave inward in front and is concave outward behind. It is much narrower in its middle than near

its extremities, and there is often a marked external projection in its anterior third. On the crest are external and internal lips and an intermediate space.

The **anterior superior spine** is the projection at the anterior extremity, below which is a concavity, the lesser iliac notch, and below this notch is the **anterior inferior spine**. The **posterior superior spine** is the projection at the posterior extremity of the crest, and is separated by a small notch from the **posterior inferior spine** below which is the great sciatic notch.

To the **external lip from before backward** (Plate XLIII) are attached (1) Tensor vaginae femoris, (2) External oblique of abdomen, (3) Latissimus dorsi, (4) Gluteus maximus, (5) The fascia lata throughout the entire length of the lip.

To the **internal lip from before backward** (Plate XLIV.) are attached (1) Transversalis abdominalis, (2) Quadratus lumborum, (3) Erector spinae, (4) The Iliacus muscle and iliac fascia to that part of this lip corresponding to the internal iliac fossa.

To the **intermediate space** is attached the Internal oblique of the abdomen. The anterior superior spine has attached (1) Tensor vaginae femoris externally, (2) Sartorius in front, (3) Poupart's ligament internally.

The straight head of the Rectus femoris arises from the anterior inferior spine of the ilium.

The **external surface or dorsum ilii**, has three curved lines called the gluteal lines. The **SUPERIOR OR POSTERIOR GLUTEAL LINE** begins two inches in front of the posterior superior spine and curves down and forward to the back part of the ilio-sciatic notch. The **MIDDLE GLUTEAL LINE** begins in front about an inch and a half behind the anterior superior spine, and arches back and down to the upper part of the notch. The **INFERIOR GLUTEAL LINE**, not so well marked, begins just above the anterior inferior spine, and passes back to the fore part of the notch.

The Gluteus maximus is attached behind the superior gluteal line to a semi-lunar area which is rough above. The falciform space between the superior and middle curved lines and the iliac crest is occupied by the Gluteus medius. The Gluteus minimus is between the middle and inferior curved lines. The reflected head of the Rectus femoris is attached just above the cotyloid cavity to an oblong mark.

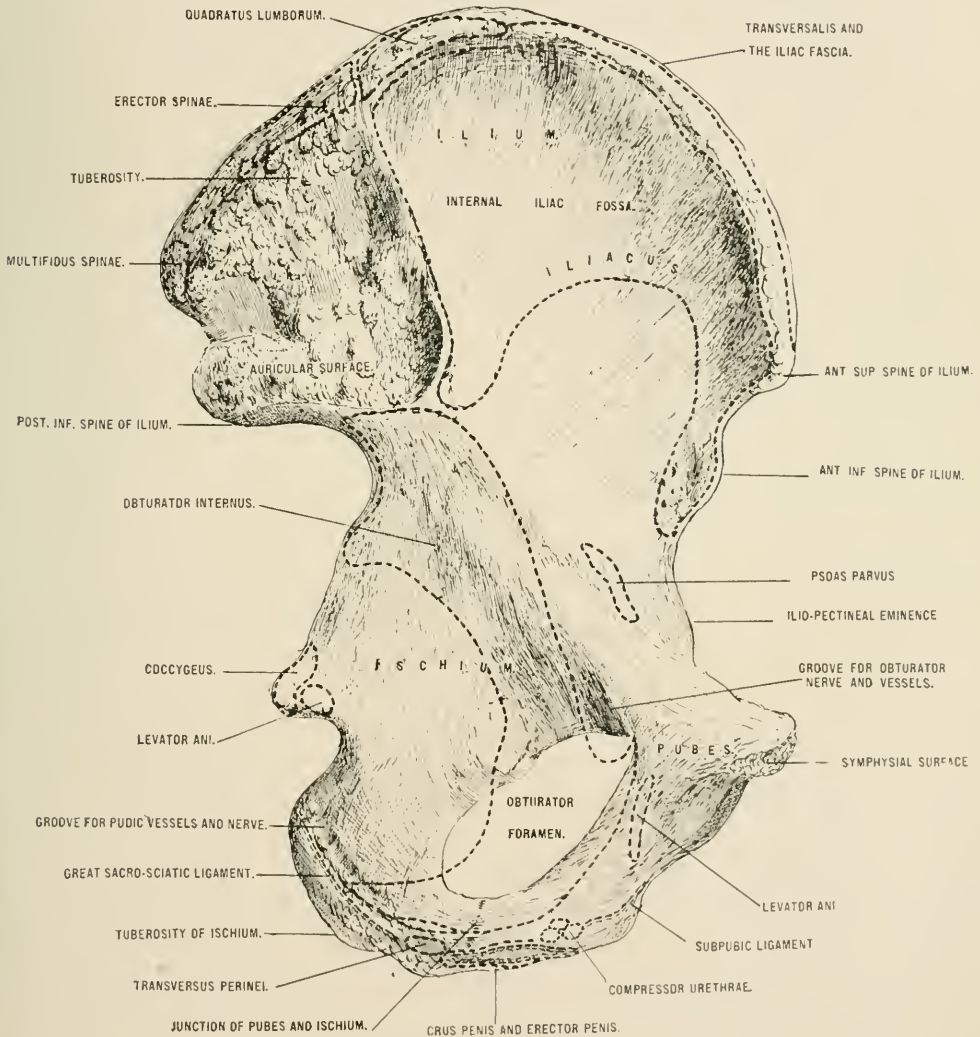
The **iliac fossa or venter ilii** is the antero-superior part of the internal surface and is larger than the postero-inferior part. It gives attachment to the Iliacus muscle except at its antero-inferior portion. The venter is smooth and concave. The ilio-pectineal line separates this part from the true pelvis.

To the inner side of the anterior inferior spine is a shallow groove, the **great iliac notch**, which lodges the Ilio-psoas muscle as it passes under Poupart's ligament; the inner boundary of the groove is the ilio-pectineal eminence, making the junction of the pubis and ilium. The postero-inferior part is again divided, presenting from below upward (1) a smooth curved surface in the true pelvis, giving attachment in part to a portion of the Obturator internus, separated from the iliac fossa by the iliac portion of the ilio-pectineal line; (2) the auricular surface, for articulation with the sacrum; (3) depression for the posterior sacro-

iliac ligament: (4) a rough surface giving origin to the Erector and Multifidus spinæ muscles.

BLOOD SUPPLY:—The **ilium** receives on its anterior surface twigs from the ilio-lumbar, deep circumflex iliac, and obturator arteries. On the dorsum arteries enter it from the gluteal and sciatic trunks.

PLATE XLIV.



INTERNAL VIEW OF LEFT INNOMINATE BONE.

The **ischium** is supplied by the obturator, internal and external circumflex. The **pubis** receives twigs from the obturator, internal and external circumflex, deep epigastric, and pubic branch of the common femoral artery. These three bones form the os innominatum.

OSSIFICATION from eight centers.

There is one primary center for the ilium which appears at the eighth or ninth week. One for the ischium at about the third month, and one for the os pubis between the fourth and fifth month. These three primary centers unite through a Y-shaped piece at about the age of puberty. There are five secondary centers—one for the CREST of the ilium, one for the ANTERIOR INFERIOR SPINOUS PROCESS, one for the TUBEROSITY OF THE ISCHIUM, one for the SYMPHYSIS PUBIS, and one or more for the BOTTOM OF THE ACETABULUM. Epiphyses appear about the age of puberty and unite with the rest of the bone between the twentieth and twenty-fifth years.

ARTICULATES with its fellow of the opposite side, the sacrum and femur.

ATTACHMENT OF MUSCLES to **the ilium**, SIXTEEN. To the outer lip of crest, the (1) Tensor vaginae femoris, (2) Obliquus externus abdominis, and (3) Latissimus dorsi; to the internal lip, the (4) Iliacus, (5) Transversalis, (6) Quadratus lumborum, and (7) Erector spinae; to the interspace between the lips, the (8) Obliquus internus. To the outer surface of the ilium, the (9) Gluteus maximus, (10) Gluteus medius, (11) Gluteus minimus, reflected tendon of the (12) Rectus; to the upper part of the great sacro-sciatic notch, a portion of the (13) Piriformis; to the internal surface, the Iliacus, to that portion of the internal surface below the linea ilio-pectinea, the (14) Obturator internus and the (15) Multifidus spinae to the internal surface of the posterior superior spine; to the anterior border, (16) the Sartorius and straight tendon of the Rectus.

To **the ischium**, FOURTEEN:—To the outer surface of the ramus, the (1) Obturator externus and (2) Adductor magnus; to the internal surface, the (3) Obturator internus and (4) Erector penis. To the spine, the (5) Gemellus superior, (6) Levator ani, and (7) Coccygeus. To the tuberosity, the (8) Biceps, (9) Semitendinosus, (10) Semimembranosus, (11) Quadratus femoris, (12) Adductor magnus, (13) Gemellus inferior, (14) Transversus perinaei, Erector penis.

To **the os pubis**, SIXTEEN: (1) Obliquus externus, (2) Obliquus internus, (3) Transversalis, (4) Rectus, (5) Pyramidalis, (6) Psoas parvus, (7) Pectineus, (8) Adductor magnus, (9) Adductor longus, (10) Adductor brevis, (11) Gracilis, (12) Obturator externus, (13) Obturator internus, (14) Levator ani, (15) Compressor urethrae, and occasionally a few fibers of the (16) Accelerator urinae.

LESSON XXXIII.

THE OS PUBIS.

The **os pubis** which consists of a body and two rami forms the anterior wall of the pelvis, and bounds the obturator foramen above and partly in front. The SYMPHYSIS PUBIS is the junction of this bone with its fellow. It is the inner extremity of the bone facing inward being of an oblong surface marked by transverse ridges. The DESCENDING RAMUS passes down and out from the symphysis. It is thin and flat and joins the ramus of the ischium at a point little more than half way from the body of the pelvis to the tuberosity of the ischium. The SUPERIOR OR ASCENDING RAMUS is the upper part of the bone. This ramus ends

externally at the cotyloid cavity and forms more than one-fifth of it. The superior border of this ramus forms the pubic portion of the ilio-pectineal line, running from the spine of the pubis to the internal aspect of the ilio-pectineal eminence.

The part between the two rami is THE BODY of the os pubis. Its anterior surface is rough and its pelvic surface is smooth. The Pectineus muscle has its origin from the ilio-pectineal line and the triangular surface in front of it. The OBTURATOR CREST extends from the pubic spine to the acetabulum below the ilio-pectineal line. The OBTURATOR GROOVE is on the inferior surface of the ramus behind the outer part of the crest. It is directed from behind forward and inward.

The PUBIC CREST gives origin to part of the (1) Conjoined tendon, (2) the Pyramidalis and (3) Rectus abdominis. To THE PUBIC SPINE are inserted (1) Poupart's ligament and the (2) outer pillar of the external abdominal ring. FROM THE FRONT OF THE PUBIS, in the angle between the crest and the symphysis, arises the (1) Adductor longus muscle, and below this the (2) Adductor brevis and part of the (3) Adductor magnus. INTERNAL TO THESE THE (1) Gracilis is attached, and external the (2) Obturator externus. POSTERIORLY the pubis gives attachment to the (1) Obturator internus; above this is sometimes a FLAT LINE passing from the upper margin of the obturator foramen to the lower end of the symphysis; the (1) Levator ani muscle is attached to it, and (2) the Obturator and recto-vesical fasciæ.

THE ISCHIUM.

The **ischium** forms the lower and back part of the innominate bone. It forms a little more than two-fifths of the cotyloid cavity and bounds the obturator foramen below.

This bone has a **body**, a **tuberosity**, and a **ramus**. The body has three surfaces and three borders. The surfaces are external, internal and posterior. The borders are also external, internal and posterior.

The **external surface** helps form the acetabulum, and this part is smooth and concave. Immediately below the acetabulum is a horizontal groove for the tendon of the Obturator externus.

The **internal surface** forms part of the wall of the true pelvis. In shape it is roughly quadrilateral, also smooth and concave to a small degree. A ridge showing its junction with the ilium is its upper limit. Its anterior limit is its junction with the os pubis and the obturator foramen. Its posterior limit is the anterior margin of the great sciatic notch. Its lower limit is the tuberosity. A part of the Obturator internus muscle is attached to this surface.

Posterior surface is limited in front by the margin of the cotyloid cavity. It is limited behind by the posterior margin of the bone. It is limited above by its connection with the ilium, and it is limited below by the tuberischii. This surface supports the two Gemelli, the Pyriformis and the Obturator internus. Below it presents a part of the groove for the Obturator externus.

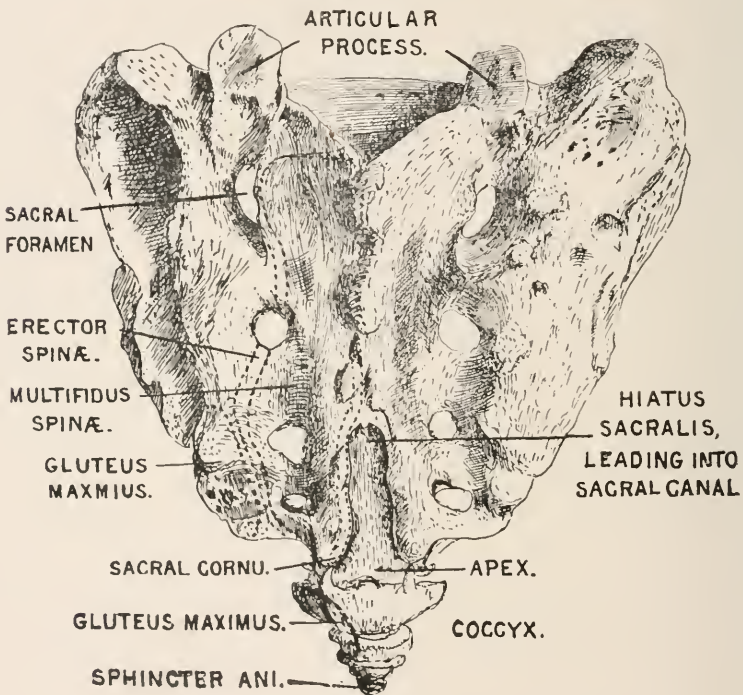
The **external border** is synonymous with that part of the rim of the Acetabulum which belongs to the ischium.

The **internal border** is synonymous with the outer boundary of the obturator foramen.

The **posterior border** has the spine of the ischium a little below its middle. This spine which extends backward and inward marks the lower limit of the great sciatic notch. It gives attachment to the Levator ani and Coccygeus muscles, externally to the Gemellus superior. Between this spine and the tuberosity is the lesser sciatic notch. THE TUBEROSITY HAS THREE SURFACES—external, internal, and postero-inferior.

THE EXTERNAL SURFACE of the tuberosity is lost below in the ramus and above with the groove for the tendons of the Obturator externus. It is limited in front by posterior margin of the thyroid foramen, and externally by the pos-

PLATE XLV.



POSTERIOR VIEW OF SACRUM AND COCCYX.

tero-inferior surface. The muscles attached to this surface are the Quadratus femoris on the posterior aspect, the Obturator externus on the antero-inferior aspect, and the Adductor magnus below these two.

THE INTERNAL SURFACE of the tuberosity extends to the thyroid foramen in front. Behind and below it ends in a prolongation for the attachment of the great sciatic ligament.

THE POSTERO-INFERIOR SURFACE of the tuberosity has the Semimembranosus attached to its upper and outer portion, while the Biceps and Semitendinosus are attached to its lower and inner portion.

The **ramus of the ischium** is not as long as the ramus of the os pubis which

it joins at a little less than half the distance between the body of the os pubis and the tuberosity of the ischium. The Obturator externus, the Adductor magnus and the Gracilis are attached to its outer surface. The Crus penis and Transversus perinei are attached to its inner border.

The **cotyloid cavity**, or **acetabulum**, is cup shaped. It looks outward, forward and downward. The Ilium forms a little less than two-fifths of the acetabulum. The os pubis forms a little more than one-fifth of the acetabulum. The Ischium forms a little more than two-fifths of the acetabulum. The rim of this cavity is prominent, but it is slightly lower in front and behind and has a large notch below called the cotyloid notch. The depression in the center is called the cotyloid fossa, around which is the articular portion of the cotyloid cavity.

The **thyroid** or **obturator foramen**—sometimes called foramen ovale is below and internal to the acetabulum. This foramen is closed by a fibrous membrane, leaving a space for the obturator groove in its upper margin. In the male this foramen is nearly oval, while in the female it is more triangular.

LESSON XXXIV.

THE PELVIS AS A WHOLE.

The **word pelvis** means basin. It is composed of four bones, the **SACRUM**, **COCCYX**, and the **TWO INNOMINATE**. If we pass a plane through the sacral promontory, ilio-pectineal line and the upper border of the symphysis, we divide the pelvis into an upper or false pelvis and a lower or true pelvis. The upper pelvis really belongs to the abdomen. The sacrum looks downward and forward. Its anterior surface is broader than its posterior surface. It is held in place by ligaments and the projections into the iliac articular surface. The plane separating the true and false pelvis marks an angle of 60 degrees with the horizontal. The plane of this outlet makes an angle of 16 degrees with the horizontal.

The **base** of the sacrum is about three and one-half inches above the upper margin of the symphysis. The tip of the coccyx is one-half inch above the apex of the subpubic arch.

The **ANTERO-POSTERIOR DIAMETER**, CALLED THE **CONJUGATE DIAMETER**, is measured from the sacro-vertebral angle to the symphysis.

The **TRANSVERSE DIAMETER** represents the greatest width of the pelvic cavity.

The **OBLIQUE DIAMETER** is measured from the sacro-iliac joint of one side to the ilio-pectineal eminence of the other.

The average measurements of the diameters of the pelvis in the three planes are as follows:

	ANTERO-POSTERIOR.	OBLIQUE.	TRANSVERSE.
Inlet	4 1-4 inches.....	5 inches.....	5 1-4 inches
Cavity	4 3-4 inches.....	5 1-4 inches.....	5 3-4 inches
Outlet	3 3-4 inches.....	4 1-2 inches.....	4 1-4 inches

THE FEMALE PELVIS DIFFERS FROM THE MALE PELVIS IN THE FOLLOWING RESPECTS:

(1) The bones are more slender, (2) ilia more vertical, (3) iliac fossa is shallower, (4) false pelvis is relatively narrower, (5) the true pelvis is shallower, also (6) true pelvis is wider, (7) inlet is more oval, (8) symphysis is shallower, (9) tuberosities of ischia are everted, (10) pubic arch is wider and more rounded, (11) margins of ischio-pubic rami are less everted, (12) obturator foramen is triangular, while in the male it is oval, (13) sacrum is wider and less curved, and (14) the capacity of the true pelvis is greater.

THE SACRUM.

The **sacrum** is formed by the coalescence of five segments. It forms the upper and back part of the pelvis, being placed between the two innominate bones. It is a wedge shaped bone with its apex below, and its anterior surface wider than its posterior surface.

The **anterior border** of the upper portion or base is called the promontory. It has FOUR SURFACES, a BASE, an APEX, and a CENTRAL CANAL.

The **anterior surface** has four ridges marking the junction of the five segments. This surface is concave, both vertically and transversely (less so.) The five segments or vertebræ decrease from above downward. At the ends of the transverse ridges are foramina for the transmission of the sacral nerves. These foramina are directed forward and outward. At the sides of the foramina are the lateral masses formed by the transverse processes of the vertebræ of the sacrum.

The **posterior surface** is not as wide as the anterior one and is convex. It has rudimentary SPINOUS PROCESSES in its median line. There are usually three or four of these, the fifth one being undeveloped. External to the processes are the LAMINÆ, the first three are well marked; the fourth is not well developed and the fifth is rarely so. The fifth ones are prolonged downward forming the sacral cornua. External to the laminæ are the ARTICULAR PROCESSES, the first pair are large, the second and third small, and fourth and fifth are most always fused. External to the articular processes are the FORAMINA for the posterior divisions of the sacral nerves. External to the foramina are the TRANSVERSE PROCESSES.

The **sacral groove** is wide and shallow lodging the Erector spinæ. It lies between the spinous and transverse processes.

The **lateral surface** is narrow behind but broad above. The upper half of this surface is called the auricular surface. It articulates with the ilium and is covered with fibro-cartilage in the recent state. Behind this articular surface are deep impressions for the attachment of the posterior sacro-iliac ligaments. The lower half of this surface is called the tuberosity, and the borders of this half of the surface give attachment to the sacro-sciatic ligaments and part of the Gluteus maximus.

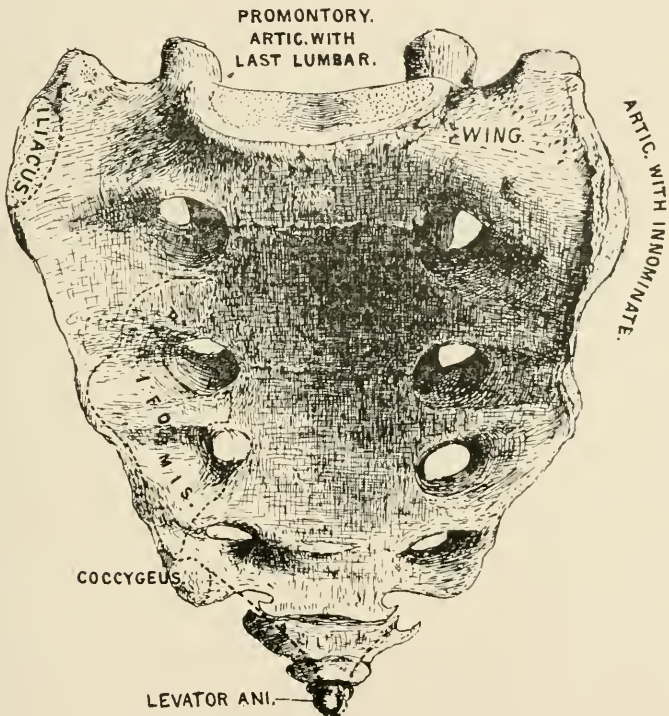
The **base** is the part which articulates with the last lumbar vertebra. It is broad and looks upward and forward. Its anterior part is for the interarticular fibro-cartilage and is oval. Its posterior part has the sacral canal which is

formed by the laminae and spinous process. The superior articular processes are oval and concave. They are situated on each side of the sacral canal and are directed backward and inward. The intervertebral notches are in front of these processes.

The **ALÆ** are flat triangular areas on each side of the articular processes, and are continuous with the iliac fossa. The Iliacus muscle has a few fibers of origin from the ala.

The **apex** articulates with the coccyx and is directed downward and forward.

PLATE XLVI.



ANTERIOR VIEW OF SACRUM AND COCCYX.

The **spinal canal** is larger and triangular above, but below it is flattened from before backward. The lower part of its posterior wall is incomplete. This is caused by the non-development of the laminae and spinous processes.

OSSIFICATION:—Thirty-five centers.

ARTICULATION:—With four bones; the last lumbar vertebra, coccyx, and the two ossa innominata.

ATTACHMENT OF MUSCLES:—Eight pairs; in front, the Pyriformis and Coccygeus, and a portion of the Iliacus to the base of the bone; behind, the Gluteus maximus, Latissimus dorsi, Multifidus spinæ, and Erector spinæ, and sometimes the Extensor coccygeus.

THE COCCYX.

The **coccyx** is formed by four and sometimes five segments. It has no SPINAL CANAL, INTERVERTEBRAL FORAMINA, SPINOUS PROCESSES, LAMINÆ, PEDICLES. The first segment may be separate but the rest are united and run to a point. This bone has an anterior and posterior surface, two borders, a base, and an apex.

The **anterior surface** has three transverse grooves marking the union of the segments. This surface is concave.

The **posterior surface** is convex and has grooves similar to those on the anterior. The upper cornua are large and articulate with the cornua of the sacrum making the fifth posterior sacral foramina.

The **lateral borders** are thin and present small eminences—the rudimentary transverse processes. The upper pair of the processes may articulate with the inferior lateral angles of the sacrum, thus forming the fifth anterior sacral foramina. The other processes are small and may be absent.

BLOOD SUPPLY:—Sacra media.

OSSIFICATION:—Four centers.

ARTICULATION:—With the sacrum.

ATTACHMENT OF MUSCLES:—Four pairs and one single muscle; on either side, the Coccygeus; behind, the Gluteus maximus and Extensor coccygeus, when present; at the apex, the Sphincter ani; and in front, the Levator ani.

LESSON XXXV.

Psoas magnus.—DESCRIPTION.—(Plate LXXIII.) In the posterior part of the substance of this muscle, the lumbar plexus is situated. This muscle, which is placed on each side of the spine in the lumbar region and the margin of the pelvis, is a long and fusiform one. It is attached by five slips to the intervertebral substance and the adjacent parts of the vertebra above and below. Between these slips are tendinous arches which with the concave part of the body of each lumbar vertebra make a passage for the lumbar vessels and filaments of the sympathetic nerve. As the muscle passes down it decreases in size and passing under Poupart's ligament, it terminates in a tendon after having received nearly all the fibers of the Iliacus.

ORIGIN:—(Plate LXXIII.) (1) Front of bases of lumbar vertebræ by five fleshy slips; (2) sides of bodies and intervertebral substances of last dorsal and all the lumbar vertebræ.

INSERTION:—(Plates XLVIII-XLIX.) Lesser trochanter of the femur.

ACTION:—Flexes thigh on pelvis; maintains erect posture.

NERVE SUPPLY:—Anterior branches of second and third lumbar nerves.

BLOOD SUPPLY:—Ilio-lumbar from posterior branch of internal iliac, and lumbar from abdominal aorta.

Psoas parvus.—DESCRIPTION.—(Plate LXXIII.) This muscle may be absent or double. It is situated in front of the Psoas and ends in a long flat tendon. It is well developed in those animals which are swift runners, in that it flexes the pelvis and arches the lumbar spine.

ORIGIN:—(Plate LXXIII.) Sides of bodies of last dorsal and first lumbar vertebræ and substance between.

INSERTION:—(Plate XLIV.) Ilio-pectineal eminence and by its outer border into the iliac fascia.

ACTION:—Same as Psoas magnus, also makes tense the iliac fascia.

NERVE SUPPLY:—Anterior branch of first lumbar.

BLOOD SUPPLY:—Lumbar from abdominal aorta.

Iliacus.—**DESCRIPTION.**—(Plate LXXIII.) The Iliacus and the Psoas magnus are sometimes regarded as one muscle, the Ilio-psoas, since they have one insertion. The Iliacus which is flat and triangular fills the whole of the iliac fossa.

ORIGIN.—(Plates XLIV-XLVI.)—(1) Upper two-thirds of iliac fossa and inner margin of crest of ilium; (2) in front, anterior superior and inferior spinous process of ilium and notch between; (3) behind, ilio-lumbar ligament and base of sacrum; (4) fibers from capsule of hip-joint.

INSERTION.—(Plate XLVIII.)—Outer side of tendon of Psoas muscle and into oblique line extending from lesser trochanter to linea aspera.

ACTION.—Flexes thigh on pelvis and rotates femur outward; also aids in maintaining erect posture.

NERVE SUPPLY.—Anterior branches of second and third lumbar through the anterior crural.

BLOOD SUPPLY.—Ilio-lumbar.

Tensor vaginæ femoris.—**DESCRIPTION.**—(Plate LXIV.)—This muscle lies along the outer side of the thigh and extends from the crest of the ilium to about one-fourth the distance to the knee.

ORIGIN.—(Plate XLIII.)—Anterior portion of outer lip of crest of ilium and outer surface of anterior superior spinous process between Gluteus medius and Sartorius muscle, and from fascia covering the Gluteus medius.

INSERTION.—(Plate LXIV.)—Between the two layers of the fascia lata. The fascia is continued downward to external tuberosity of the tibia as a thickened band, the ilio-tibial band.

ACTION.—Tenses fascia lata.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through the superior gluteal.

BLOOD SUPPLY.—Superior gluteal and external circumflex.

Sartorius.—**DESCRIPTION.**—(Plate LXXIV.)—This muscle, which extends from the ilium to the tibia, is flat, narrow, ribbon-like, and is the longest one in the body. In the upper part of its course it forms the outer boundary of Scarpa's triangle. It passes downward, then obliquely inward, then downward to the insertion.

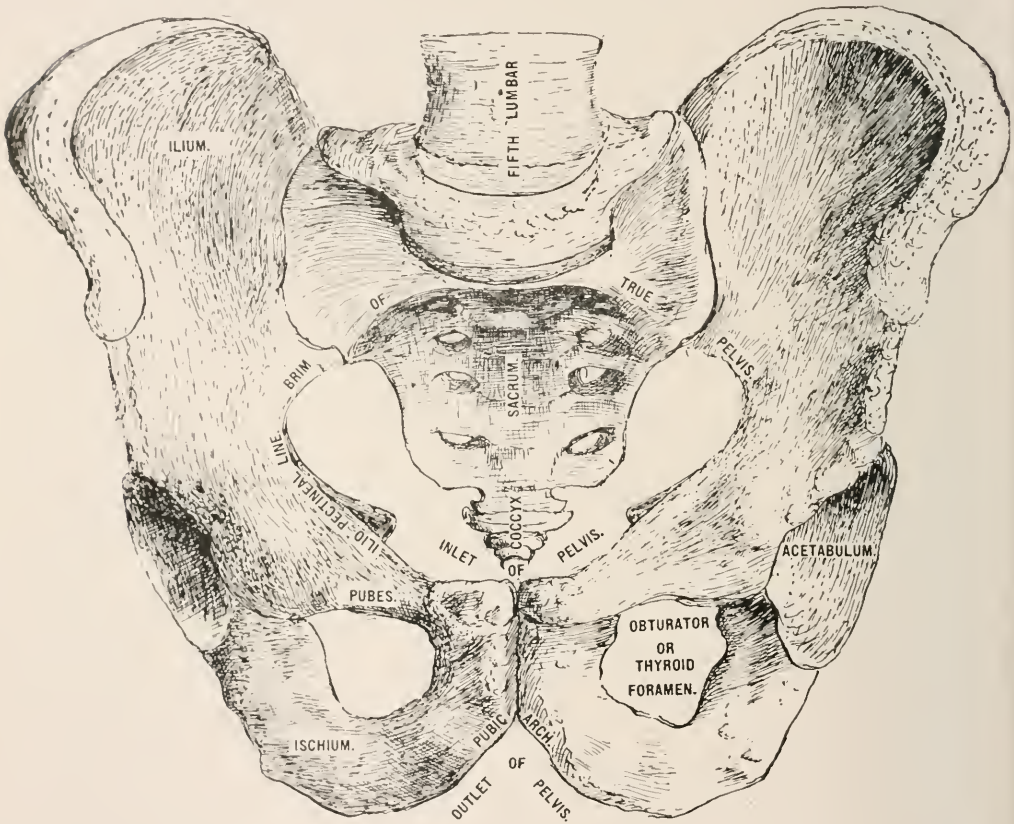
SCARPA'S TRIANGLE (Plates LXIV-LXXIV.)—Is bounded above by Poupart's ligament. On the outer side by the Sartorius and on its inner side by the Adductor longus. The femoral vessels and the anterior crural nerve pass through its center from above down. Their position from within outward is—femoral vein, artery, and anterior crural nerve (V. A. N.). The floor of this triangle from without inward is formed by the Iliacus, Psoas, Pectineus, (Adductor brevis?)

and Adductor longus. In the middle third of the thigh the femoral artery lies first along the inner border and then behind the Sartorius.

ORIGIN.—(Plate XLIII).—Anterior superior spinous process of ilium and upper half of notch below.

INSERTION.—(Plate LI).—The muscle passes behind the inner condyle of the femur and terminates in a tendon which, curving obliquely forward, expands into a broad aponeurosis and is inserted into the upper part of the inner surface of the shaft of the tibia, nearly as far forward as the crest. An offset is

PLATE XLVII.



ANTERIOR AND SUPERIOR VIEW OF THE PELVIS.

derived from the upper margin of this aponeurosis which blends with the fibrous capsule of the knee-joint, and another, given off from its lower border, blends with the fascia on the inner side of the leg.

ACTION.—Flexes leg on thigh and continuing to act flexes the thigh on the pelvis; also rotates the thigh outward.

NERVE SUPPLY.—Branch of anterior crural.

BLOOD SUPPLY.—Femoral artery.

Rectus femoris.—**DESCRIPTION.**—(Plates LXIV-LXVIII-LXXIV.)—The Rectus femoris together with the Vastus externus, Vastus internus, and the

Crureus, form one muscle—the Quadriceps extensor, which is the great extensor of the leg. This might be called one muscle with four heads and one insertion. The Rectus is situated in the middle and anterior part of the group and has two heads. These heads join at an acute angle. Its superficial fibers are bipenniform, and its deep ones run straight down to the deep aponeurosis. The broad and thick aponeurosis which occupies the lower two-thirds of the posterior surface of the muscle gradually ends in a flattened tendon.

LESSON XXXVI.

ORIGIN.—(Plate XLIII.)—The anterior or straight tendon, from the anterior inferior spinous process of ilium; the posterior, or reflected tendon, from a groove above the brim of the acetabulum.

INSERTION.—(Plate LXXIV.)—Into the patella in common with the Vasti and Crureus.

ACTION.—Assists Psoas muscle to bend pelvis and trunk forward and support them upon the femur.

NERVE SUPPLY.—Anterior crural.

BLOOD SUPPLY.—Femoral artery.

Vastus externus.—DESCRIPTION.—(Plates LXIV-LXVIII-LXXIV.)—This muscle is the largest part of the Quadriceps extensor. The strong aponeurosis on the under surface at the lower part of this muscle receives the fibers which form a large fleshy mass. The tendon of this muscle gives an expansion to the capsule of the knee-joint.

ORIGIN.—(Plate XLVIII.)—By a broad aponeurosis attached to the upper half of anterior intertrochanteric line, to the anterior and inferior borders of the root of the great trochanter, to the outer lip of the gluteal ridge, and to the upper half of the outer lip of the linea aspera. This aponeurosis covers the upper three-fourths of the muscle and from its inner surface many fibers take origin. A few additional fibers arise from the tendon of the Gluteus maximus, and from the external intermuscular septum between the Vastus externus and short head of Biceps.

INSERTION.—(Plate LXXIV.)—Into patella.

ACTION.—Extends knee.

NERVE SUPPLY.—Anterior crural.

BLOOD SUPPLY.—External circumflex.

Vastus internus.—DESCRIPTION.—(Plates LXIV-LXVIII-LXXIV.)—If the Rectus is reflected a narrow space is seen between the Vastus internus and the Crureus extending upward from the inner border of the patella. At this space they can be separated, but they are in reality one muscle. The aponeurosis which lies on the deep surface of the muscle receives fibers from the muscle, which are directed downward and forward.

ORIGIN.—(Plate XLVIII.)—Lower one-half of anterior intertrochanteric line, the spiral line, the inner lip of the linea aspera, the upper part of the internal supracondylar line, and the tendon of the Adductor magnus and internal intermuscular septum.

INSERTION.—(Plate LXXIV.)—By common extensor tendon into the patella, an expansion being sent to capsule of knee-joint.

ACTION.—Extends leg and draws patella inward.

NERVE SUPPLY.—Branches of anterior crural.

BLOOD SUPPLY.—Femoral artery.

Crureus.—**DESCRIPTION.**—Given with Vastus internus.

ORIGIN.—(Plate XLIX.)—From front and outer aspect of shaft of femur in its upper two-thirds and from the lower part of the external intermuscular septum.

INSERTION.—(Plate LXXIV.)—Its fibers end in a superficial aponeurosis which forms the deep part of the Quadriceps extensor tendon.

ACTION.—Extends leg and draws patella inward.

NERVE SUPPLY.—Branches of anterior crural.

BLOOD SUPPLY.—Femoral artery.

Subcrureus.—**DESCRIPTION.**—This muscle may consist of several muscular bundles, but it is a small muscle. It is most always distinct from the Crureus, but may be attached to it.

ORIGIN.—(Plate XLIV.)—Anterior surface of lower part of shaft of femur.

INSERTION.—(Plate LXXIV.)—Upper part of cul de sac of capsular ligament.

ACTION.—Lifts capsule.

NERVE SUPPLY.—Branches of anterior crural.

BLOOD SUPPLY.—Femoral artery.

Gracilis.—**DESCRIPTION.**—(Plates LXIV-LXVIII-LXXIV.)—This muscle is broad above, narrow below, thin and flattened as a whole. Its fibers after passing downward end in a rounded tendon, then passes behind the internal condyle of femur to curve round the inner tuberosity of the tibia. It becomes flattened before its insertion. It is the most superficial muscle in the Internal Femoral Region. Its tendon which is just above that of the Semitendinosus and below that of the Sartorius joins the latter. It is separated from the internal lateral ligament of the knee-joint by a synovial bursa which is common to it and the Semitendinosus.

ORIGIN.—(Plate XLIII.)—Lower half of margin of symphysis and anterior half of the pubic arch.

INSERTION.—(Plate LI.)—Upper part of inner surface of shaft of tibia below the tuberosity.

ACTION.—Assists Sartorius in flexing leg; also adducts thigh.

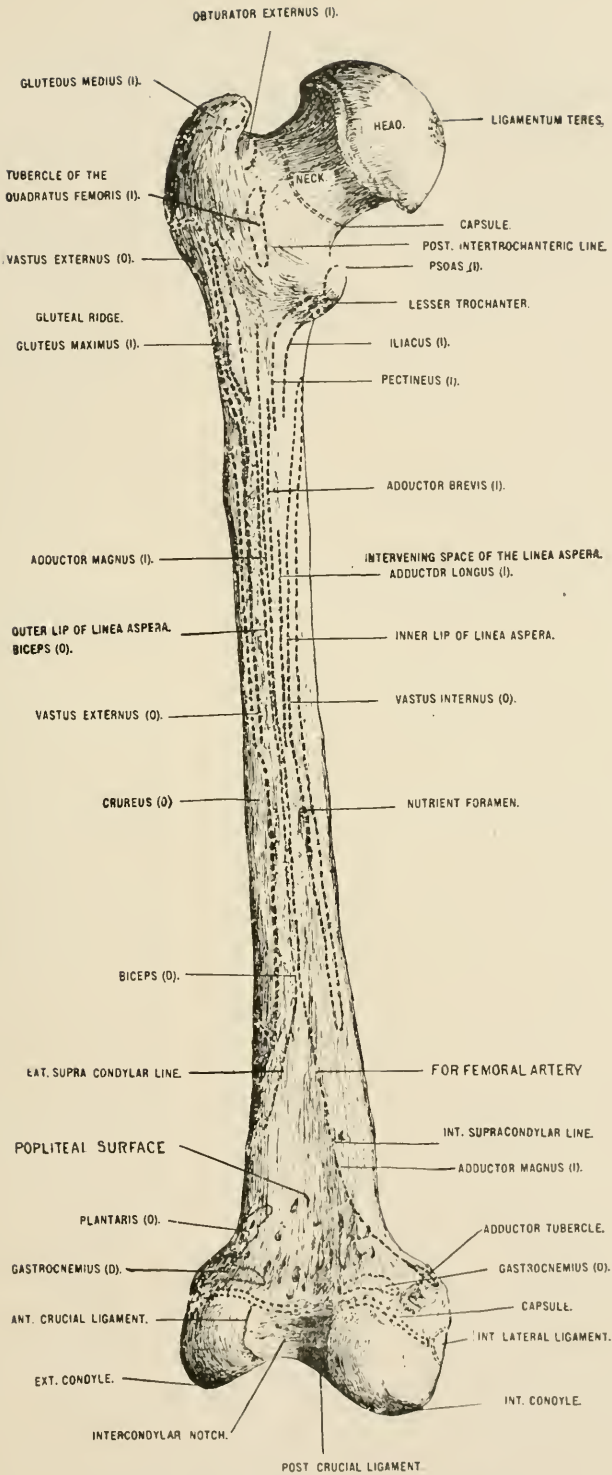
NERVE SUPPLY.—Third and fourth lumbar through the obturator nerve.

BLOOD SUPPLY.—Obturator and femoral arteries.

Pectineus.—**DESCRIPTION.**—(Plates LXIV-LXVIII-LXXIV.)—This muscle which is situated at the anterior part of the upper and inner aspect of the thigh is flat and quadrilateral.

ORIGIN.—(Plate XLIII.)—(1) Ilio-pectineal line; (2) surface of bone in front of it; (3) fascia covering anterior surface of muscle.

INSERTION.—(Plate XLVIII.)—Rough line between lesser trochanter and linea aspera.



POSTERIOR VIEW OF LEFT FEMUR.

ACTION.—Adducts thigh.

NERVE SUPPLY.—Anterior crural, obturator accessory, and occasionally a branch from the obturator.

BLOOD SUPPLY.—Femoral and obturator arteries.

Adductor longus.—**DESCRIPTION.**—(Plates LXIV-LXVIII-LXXI-LXXIV.)—This muscle forms the inner boundary of Scarpa's triangle and is the most superficial one of the Adductors. It lies on the same plane as the Pectineus. It is a flat, triangular muscle.

ORIGIN.—(Plate XLIII.)—Front of os pubis, at junction of crest with symphysis.

INSERTION.—(Plate XLVIII.)—By aponeurosis into linea aspera.

ACTION.—Adducts thigh powerfully.

NERVE SUPPLY.—Obturator.

BLOOD SUPPLY.—Obturator and perforating branches of profunda.

Adductor brevis.—**DESCRIPTION.**—(Plates LXIV-LXVIII-LXXI-LXXIV.)—The Adductor brevis, which is somewhat triangular, is situated immediately beneath the Adductor longus and the Pectineus. The second and sometimes the first perforating branches of the profunda femoris artery pierces this muscle near its insertion.

ORIGIN.—(Plate XLIII.)—Outer surface of body and descending ramus of os pubis, between Gracilis and Obturator externus.

INSERTION.—(Plate XLVIII.)—By an aponeurosis into lower part of line leading from the lesser trochanter to the linea aspera and the upper part of the same line, immediately behind the Pectineus and upper part of the Adductor longus.

ACTION.—Assists in flexing thigh upon pelvis; also in drawing leg forward in walking.

NERVE SUPPLY.—Third and fourth lumbar through the obturator.

BLOOD SUPPLY.—Obturator and perforating branches of the profunda.

LESSON XXXVII.

Adductor magnus.—**DESCRIPTION.**—(Plates LXIV-LXVIII-LXXI-LXXIV.)—The muscles of the Anterior Femoral Region are separated from the remaining muscles of the Internal Femoral Region by the Adductor magnus. Along the attachment of this muscle there are three and sometimes four openings formed by tendinous arches attached to the femur for the passage of the three perforating branches of the profunda artery. The fourth one, when present, is for the terminal branch of the profunda.

ORIGIN.—(Plate XLIII.)—(1) Descending ramus of os pubis; (2) ascending ramus of ischium; (3) outer margin of under surface of tuberosity of ischium.

INSERTION.—(Plate XLVIII.)—The fibers from the ramus of the os pubis are very short, horizontal in direction, and are inserted into the rough line leading from the great trochanter to the linea aspera, internal to the Gluteus maximus; those from the ramus of the ischium are directed downward and outward to be inserted by means of a broad aponeurosis into the linea aspera and the

upper part of its internal prolongation below. The internal portion of the muscle, consisting principally of those fibers which arise from the tuberosity of the ischium, forms a thick, fleshy mass, descends almost vertically and terminates about the lower third of the thigh in a rounded tendon which is inserted into the adductor tubercle on the inner condyle of the femur, being connected by a fibrous expansion to the line leading upward from the tubercle to the *linea aspera*.

ACTION.—Adductor of thigh.

NERVE SUPPLY.—Obturator and branch of great sciatic.

BLOOD SUPPLY.—The femoral and perforating branches of profunda.

Gluteus maximus.—**DESCRIPTION.**—(Plate LXV.)—This muscle, which is made up of fasciculi lying parallel with one another, is very coarse in structure. These fasciculi are collected together into large bundles, which are separated by deep cellular intervals. It is a thick and quadrilateral muscle and helps to hold the trunk erect. It is the most superficial muscle in the Gluteal Region. There is a synovial bursa between this muscle and the great trochanter, one between its tendon and the Vastus externus, and often one is situated on the tuberosity of the ischium.

ORIGIN.—(Plates XLIII-XLV.)—(1) Superior curved line and crest of ilium; (2) posterior surface of lower part of sacrum; (3) side of coccyx; (4) aponeurosis of Erector spinæ; (5) great sacro-sciatic ligament and fascia covering Gluteus medius.

INSERTION.—(Plate XLVIII.)—The fibers forming the upper and larger portion of the muscle, together with the superficial fibers of the lower portion, terminate in a thick tendinous lamina, which passes across the great trochanter and is inserted into the fascia lata covering the outer side of the thigh; the deeper fibers of the lower portion are inserted into the rough line leading from the great trochanter to the *linea aspera* between the Vastus externus and Adductor magnus.

ACTION.—Extends, adducts, and rotates the thigh outward.

NERVE SUPPLY.—Inferior gluteal and small sciatic.

BLOOD SUPPLY.—Superior and inferior gluteal.

Gluteus medius.—**DESCRIPTION.**—(Plate LXV.)—The posterior border of this muscle lies parallel with the Piriformis muscle but is separated from it by the gluteal vessels. The posterior one-third of its external surface lies under the Gluteus maximus, its anterior two-thirds under the fascia lata. This is a broad thick, radiating muscle situated on the outer surface of the ilium. A synovial bursa is situated between the tendon of this muscle and the surface of the great trochanter in front of its insertion.

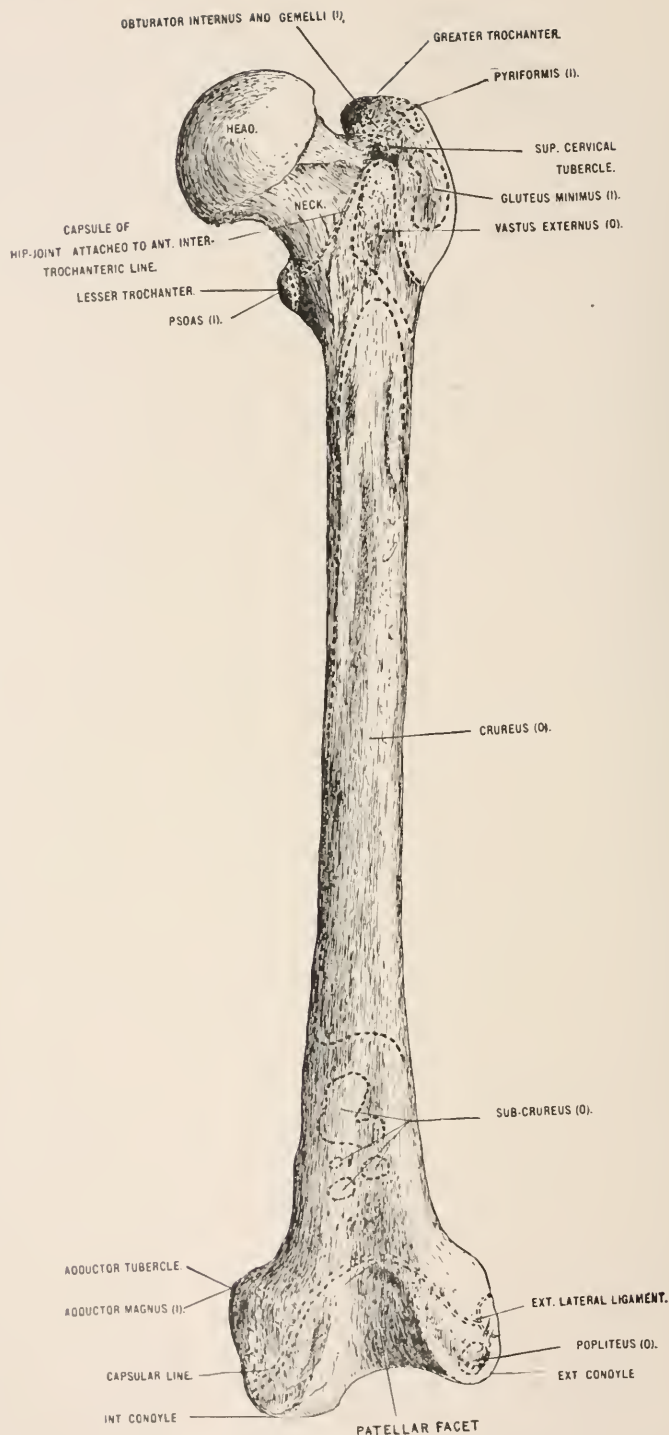
ORIGIN.—(Plates XLIII-XLV.)—Outer surface of ilium between superior and middle curved lines; (2) crest of ilium; (3) fascia covering outer surface.

INSERTION.—(Plate XLIX.)—Oblique line of great trochanter.

ACTION.—Adducts the extended thigh, rotates same and supports body on limb.

NERVE SUPPLY.—Superior gluteal.

BLOOD SUPPLY.—Superior gluteal.



ANTERIOR VIEW OF LEFT FEMUR.

Gluteus minimus.—DESCRIPTION.—(Plate LXV.)—This muscle is situated immediately beneath the Gluteus medius. It is the smallest of the three Gluteal muscles. There is a synovial bursa between its tendon and the great trochanter.

ORIGIN.—(Plates XLIII-XLV.)—Outer surface of ilium, between the middle and inferior curved lines, and from the margin of the sacro-sciatic notch.

INSERTION.—(Plate XLVIII.)—Into an impression on anterior border of great trochanter.

ACTION.—Adducts the extended thigh, rotates same and supports body on limb.

NERVE SUPPLY.—Superior gluteal.

BLOOD SUPPLY.—Superior gluteal and external circumflex.

Pyriformis.—DESCRIPTION.—(Plate LXV.)—This muscle is a flat pyramidal one situated partly within the pelvis at its posterior part and partly at the back of the hip-joint. It lies parallel with the posterior border of the Gluteus medius. It passes out of the pelvis through the great sacro-sciatic foramen, thus dividing it into two compartments. The superior gluteal nerve and the gluteal vessels leave the pelvis above this muscle. Below this muscle the inferior gluteal nerve, the sciatic vessels and nerves, internal pudic vessels and nerve, and nerves to the Obturator internus and the Quadratus femoris leave the pelvis.

ORIGIN.—(Plate XLVI.)—Front of sacrum by three fleshy digitations attached to the portions of the bone between the first, second, third and fourth anterior sacral foramina, and also from the groove leading from the foramina; also from the margin of the great sacro-sciatic foramen, and from the anterior surface of the great sacro-sciatic ligament.

INSERTION.—(Plate XLIX.)—Upper border of great trochanter behind, and partly blended with, the tendon of the Obturator internus and Gemelli muscles.

ACTION.—Draws pelvis forward when inclined backward and assists in steadying it upon the head of the femur.

NERVE SUPPLY.—First and second sacral nerves.

BLOOD SUPPLY.—Sciatic.

Obturator internus.—DESCRIPTION.—(Plate LXV.)—This muscle, like the Pyriformis, is situated partly within the pelvis and partly at the back of the hip-joint. The inner surface of the tuberosity of the ischium is grooved for the reception of the four or five tendinous bands which are on the deep surface of the muscle. These grooves are covered with cartilage and lined by a synovial bursa. These tendinous bands unite into a flattened tendon which passes horizontally outward to its insertion. Between the capsular ligament of the hip and the tendon of this muscle is a bursa, which generally communicates with the bursa between the tendon and the tuberosity of the ischium, the two bursa making one sac. It leaves the pelvis through the lesser sacro-sciatic foramen.

ORIGIN.—(Plate XLIV.)—From the inner surface of anterior and external wall of pelvis, when it surrounds the greater part of the obturator foramen being attached to the descending ramus of the os pubis and ramus of ischium, and at the side to the inner surface of the innominate bone below and behind the pelvic

brim, reaching from the upper part of the great sacro-sciatic foramen above and behind to the thyroid foramen below and in front. It also arises from the inner surface of obturator membrane except at its posterior part, from the tendinous arch which completes the canal for the passage of the obturator vessels and nerve, and to a slight extent from the obturator layer of the pelvic fascia which covers it.

INSERTION.—(Plate XLIX.)—Into the fore part of the inner surface of great trochanter in front of obturator externus, together with the Gemelli.

ACTION.—Rotates and abducts thigh.

NERVE SUPPLY.—Fifth lumbar, first and second sacral.

BLOOD SUPPLY.—Sciatic.

LESSON XXXVIII.

Gemellus superior.—**DESCRIPTION.**—(Plate LXV.)—This muscle is not always present. It is an aid to the Obturator internus. It has a common tendon with the Obturator internus. It is smaller than the Gemellus inferior.

ORIGIN.—(Plate XLIV.)—Outer surface of spine of ischium and blends with tendon of Obturator internus.

INSERTION.—(Plate XLIX.)—Inner surface of great trochanter.

ACTION.—Rotates the extended thigh, abducts the flexed thigh.

NERVE SUPPLY.—Fifth lumbar, first and second sacral.

BLOOD SUPPLY.—Sciatic and external circumflex.

Gemellus inferior.—**DESCRIPTION.**—(Plate LXV.)—This muscle is larger than the Gemellus superior and like that muscle is an aid to the Obturator internus.

ORIGIN.—(Plate LXIII.)—Upper part of tuberosity of ischium and blends with tendon of Obturator internus below.

INSERTION.—(Plate XLIX.)—Inner surface of great trochanter.

ACTION.—Rotates extended thigh, abducts flexed thigh.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral.

BLOOD SUPPLY.—Sciatic and external circumflex.

Quadratus femoris.—**DESCRIPTION.**—(Plate XLV.)—This muscle is situated between the upper margin of the Adductor magnus and the Gemellus inferior. It is flat and quadrilateral. The terminal branches of the internal circumflex vessels lie between the Adductor magnus and this muscle.

ORIGIN.—(Plate XLIII.)—Upper part of external lip of tuberosity of ischium.

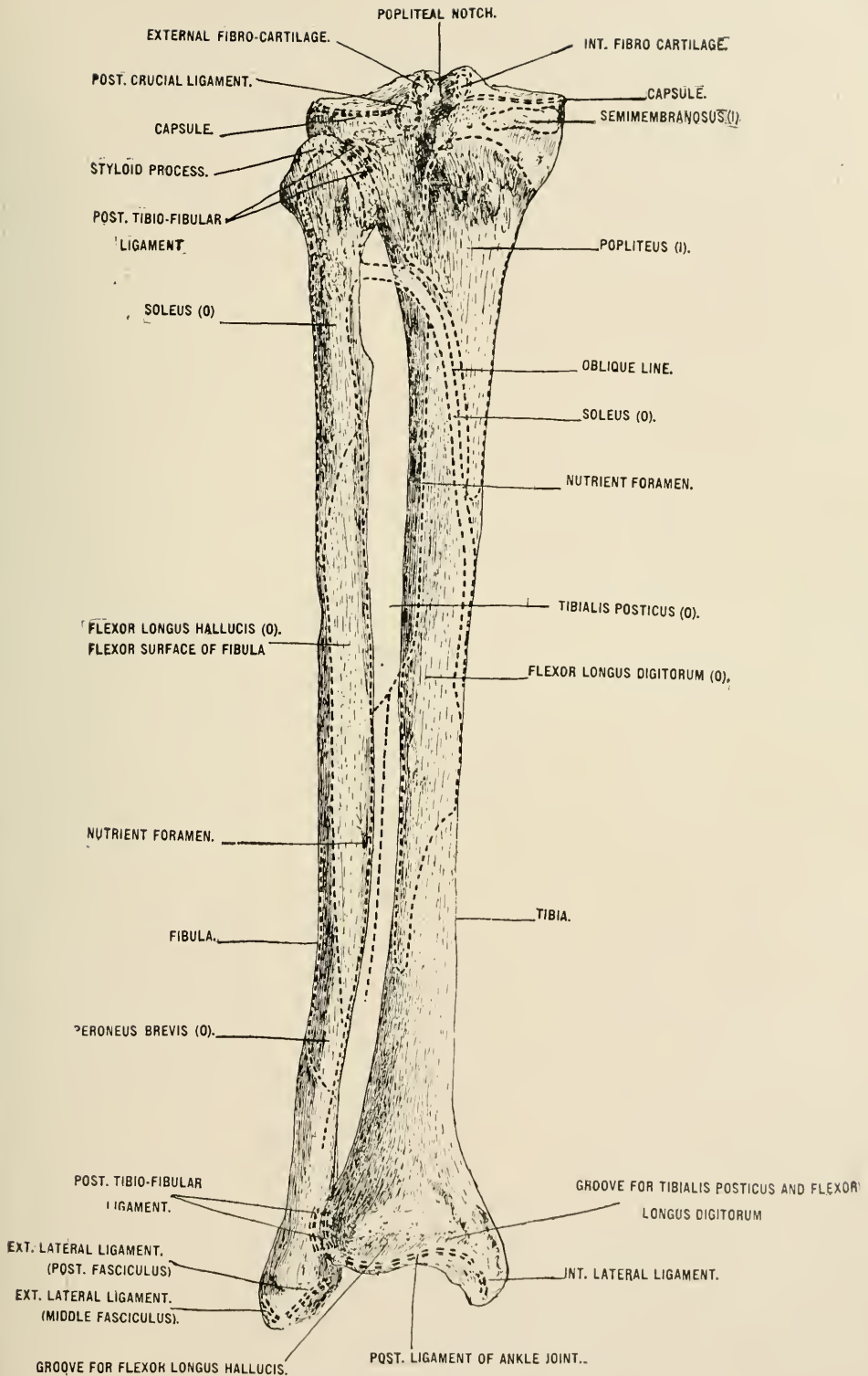
INSERTION.—(Plate XLVIII.)—Quadrate line of femur, upper part.

ACTION.—Rotates thigh outward.

NERVE SUPPLY.—Last lumbar and first sacral.

BLOOD SUPPLY.—Sciatic and internal circumflex.

Obturator externus.—**DESCRIPTION.**—(Plate LXXI.)—The deep branches of the obturator nerve perforate this muscle while the superficial ones pass above it. The obturator vessels lie between this muscle and the obturator membrane.



POSTERIOR VIEW OF LEFT TIBIA AND FIBULA.

This muscle, which covers the outer surface of the anterior wall of the pelvis, is flat and triangular.

ORIGIN.—(Plate XLIII.)—(1) Margin of inner boundary of obturator foramen; (2) inner two-thirds of outer surface of obturator membrane; (3) tendinous arch of obturator canal.

INSERTION.—(Plate XLVIII.)—Digital fossa of femur.

ACTION.—Rotates thigh outward and assists in holding head of femur in place.

NERVE SUPPLY.—Second, third, and fourth lumbar through obturator.

BLOOD SUPPLY.—Obturator and femoral.

Biceps.—**DESCRIPTION.**—(Plate LXV.)—This muscle—Biceps flexor cruris—is situated on the posterior and outer aspect of the thigh. It is quite large and its tendon forms the outer hamstring. The tendons of the Semimembranosus, Semitendinosus, Gracilis and Sartorius form the inner hamstring, and lie to the inner side of the knee-joint.

ORIGIN.—(Plate XLIII.)—By two heads; the **LONG HEAD** from the lower and inner impression on the back part of the tuberosity of the ischium, by a tendon common to it and the Semitendinosus, and from the lower part of the great sacro-sciatic ligament. The femoral, or **SHORT HEAD**, from the outer lip of the linea aspera, between the Adductor magnus and Vastus externus, extending almost as high as the insertion of the Gluteus maximus; also from the outer prolongation of the linea aspera to within two inches of the outer condyle, and from the external intermuscular septum.

INSERTION.—(Plate LI.)—The fibers of the long head form a fusiform belly, which, passing obliquely downward and a little outward, terminates in an aponeurosis which covers the posterior surface of the muscle and receives the fibers of the short head; this aponeurosis becomes gradually contracted into a tendon which is inserted into the outer side of head of fibula, and by a small slip into lateral surface of external tuberosity of tibia.

ACTION.—Flexes leg on thigh; rotates semi-flexed knee outward.

NERVE SUPPLY.—First, second, and third sacral through the great sciatic.

BLOOD SUPPLY.—Perforating branches of the profunda.

Semitendinosus.—**DESCRIPTION.**—(Plate LXV.)—This muscle is situated at the posterior and inner aspect of the thigh. It has a remarkably long tendon, which lies behind the Sartorius, and below that of the Gracilis to which it is joined. Its tendon is separated from the internal lateral ligament of the knee-joint by a bursa. About the middle of the muscle there is generally a tendinous intersection.

ORIGIN.—(Plate XLIII.)—From the lower and inner impression on tuberosity of ischium by tendon common to it and the long head of Biceps; also from aponeurosis which connects the adjacent surface of the two muscles to the extent of about three inches after their origin.

INSERTION.—(Plate LI.)—It forms a fusiform muscle which, passing downward and inward, terminates a little below the middle of the thigh in a long, round tendon which lies along the inner side of the popliteal space, then curves around the inner tuberosity of the tibia and is inserted into the upper part so

the inner surface of shaft of that bone. At its insertion it gives off a prolongation to the deep fascia of the leg.

ACTION.—Flexes leg on thigh and rotates it inward.

NERVE SUPPLY.—First, second, and third sacral through great sciatic.

BLOOD SUPPLY.—Perforating branches of the profunda.

Semimembranosus.—**DESCRIPTION.**—(Plate LXV.)—This muscle is membranous above and muscular below. It is situated at the back part and inner side of the thigh. At its origin the aponeurosis covers the upper and anterior part of the muscle, and from this aponeurosis muscular fibers arise and converge to another aponeurosis which covers the lower part of its posterior surface and contract into the tendon of insertion.

ORIGIN.—(Plate XLIII.)—By thick tendon from upper and outer impression on back part of tuberosity of ischium above and to the outer side of the Biceps and Semitendinosus.

INSERTION.—(Plate L.)—Groove on inner and back part of inner tuberosity of tibia, beneath the internal lateral ligament. At its insertion fibrous expansions are given off; one of these, of considerable size, passes upward and outward to be inserted into the back part of outer condyle of femur, forming part of posterior ligament of knee-joint; a second is continued downward to the fascia which covers the Popliteus muscle. The tendon also sends a few fibers to join the internal lateral ligament.

ACTION.—Flexes leg and rotates it inward.

NERVE SUPPLY.—First, second and third sacral through the great sciatic.

BLOOD SUPPLY.—Perforating branches of the profunda.

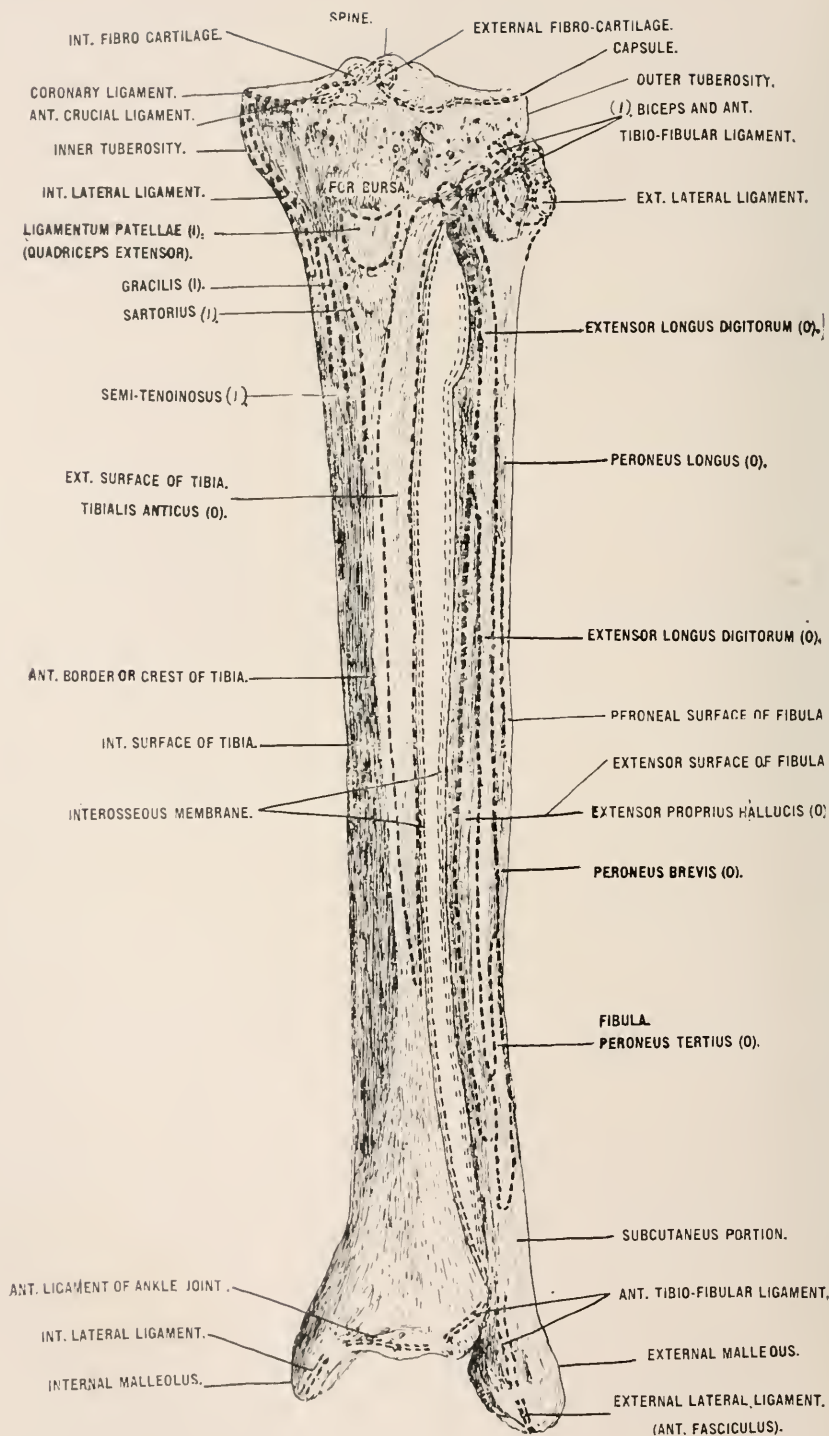
LESSON XXXIX.

FEMUR.

The **femur** (Plates XLVIII-XLIX) is about one-fourth the length of the body and is the longest and strongest as well as the largest bone in the body. When one is standing it inclines inward and a little backward. The main part is the **SHAFT OR DIAPHYSIS**. Its upper part has a **HEAD**, **NECK**, a **GREATER TROCHANTER**, and a **LESSER TROCHANTER**. Its lower part is expanded into two **CONDYLES**—an external one and an internal one. Above each one of these is a **SUPRACONDYLAR LINE**.

The **neck** makes an angle of 125 degrees with the diaphysis. It is directed upward, inward and a little forward, being broad and compressed at the base but becomes rounded at its junction with the head. It is longer below and behind than above and in front. Posteriorly and above where it joins the greater trochanter is a depression (digital fossa) for the insertion of the Obturator externus. Where it joins the shaft between the two trochanters is the **POSTERIOR INTERTROCHANTERIC LINE**. About half an inch above this line the capsular ligament of the hip-joint is attached to the neck.

The **head** is an expanded portion of the neck, and forms more than a hemisphere. It articulates with the acetabulum of the innominate bone. The **FOSSA CAPITIS** is a depression a little below and behind the center of the head.



ANTERIOR VIEW OF LEFT TIBIA AND FIBULA.

The fore part of this depression gives attachment to the **LIGAMENTUM TERES** of the hip-joint. The *fossa capitis* has one or two **VASCULAR FORAMINA**.

The **greater trochanter** is an expanded portion of the upper part of the bone opposite the head, its upper limit being about half or two-thirds of an inch below the upper limit of the head. The word trochanter means, to turn. The *Gluteus minimus* is attached to its anterior surface in a **BROAD DEPRESSION**. The *Gluteus medius* is attached to an **OBLIQUE LINE**, which runs downward and forward from the posterior aspect of its upper border. On the anterior surface of the greater trochanter is the **SUPERIOR CERVICAL TUBERCLE** of the femur, which marks the **JUNCTION** of the following muscles: *Vastus externus*, *Gluteus minimus*, *Obturator internus*, and the two *Gemelli*. Above and external to the insertion of the *Obturator internus* and the *Gemelli* is the **INSERTION** of the *Pyriformis*. About the center of the posterior intertrochanteric line is the **TUBERCLE** of the *Quadratus femoris*. The **LINEA QUADRATI**, when present, passes vertically down from this tubercle.

The **lesser trochanter** is a pyramidal projection at the junction of the lower part of the posterior intertrochanteric line and the diaphysis. Its direction is inward and backward, and its apex gives attachment to the *Ilio-psoas* muscle.

In front the neck is separated from the shaft by the **ANTERIOR INTERTROCHANTERIC LINE**, which is the upper part of the spiral line. This line commences at the tubercle of the femur, and runs down in front of the lesser trochanter. It gives attachment to the capsular ligament and the *Vastus internus* and *Crureus* muscles.

The **shaft** is arched forward; its middle is somewhat cylindrical, but below it is expanded. It has an anterior and two lateral surfaces which are not separated by well defined lines. The two *Vasti* and the *Crureus* muscles cover these surfaces. The **linea aspera** separates the two surfaces posteriorly. This line is well marked in the middle third of the thigh, bifurcating both above and below. Of its two upper divisions the external one extends to the greater trochanter making the **gluteal ridge** for the attachment of the *Gluteus maximus*. The internal division winds around below the lesser trochanter, passing into the anterior intertrochanteric line, and forming the lower part of the spiral line. **ANOTHER LINE** passes from this line to the lesser trochanter for the attachment of the *Pectineus*.

Below the *linea aspera* divides into two lines which extend to the two condyles, thus forming the **supracondylar lines**, which enclose the popliteal surface of the femur. The inner line ends at the *Adductor tubercle*, and is broken above this where the femoral vessels lie on the bone. Above the middle of the *linea aspera* is a **NUTRIENT FORAMEN**, which is directed from the knee. (Page 19.) A **SECOND FORAMEN** may exist nearer the distal end of the bone.

The **inner lip of the linea aspera** gives attachment to the *Vastus internus*, and the outer lip gives attachment to the *Vastus externus*. The *Adductor magnus* is attached between the two. Between the *Adductor magnus* and the *Vastus externus* are the *Gluteus maximus* and the short head of the *Biceps*. Between the *Adductor magnus* and the *Vastus internus* are the *Iliacus*, *Pectineus*, *Adductor brevis*, and *Adductor longus*. At the lower part of the poplitea

space above each condyle is the origin of one head of the Gastrocnemius.

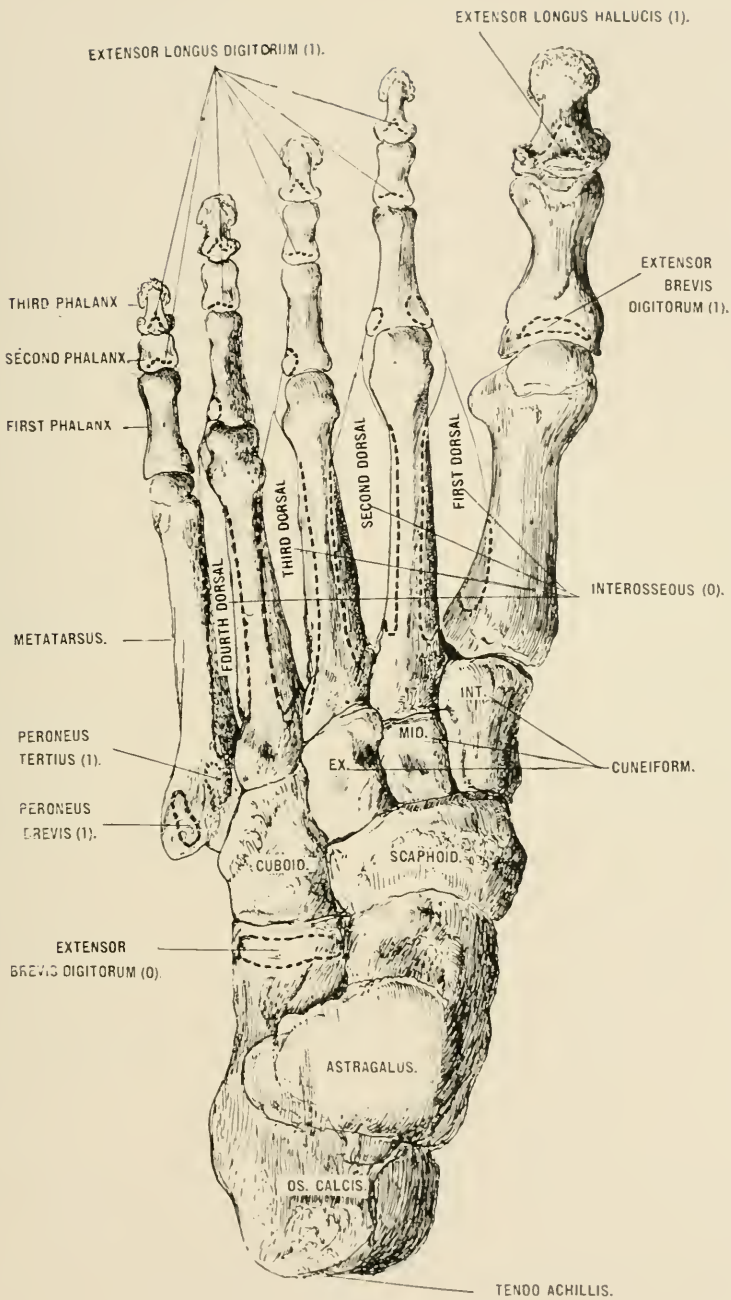
The **distal extremity has two condyles**, which are united anteriorly but separated posteriorly by the intercondylar notch. The **EXTERNAL CONDYLE** is broader and more prominent anteriorly, while the **INTERNAL ONE** is more prominent internally, and it extends to a lower level, when the femur is taken from the body. When the femur articulates with the tibia the two condyles are on the same level. Both condyles are convex for the articulation of the tibia, and between these two anteriorly is a **CONCAVE SURFACE** for the articulation of the patella. The patellar surface has a vertical hollow and two lips. The external portion which is wider and more prominent than the internal portion rises higher. The **tibial surfaces** are almost parallel being a little closer anteriorly than posteriorly. The lateral surface of each condyle extends into a tuberosity or epicondyle, which gives attachments to ligaments. Above the external condyle is a depression for the outer head of the Gastrocnemius. The inner head of the Gastrocnemius arises from the upper part of the inner condyle. The **INTERCONDYLEAR FOSSA** has two depressions for the crucial ligaments. The **ONE FOR THE ANTERIOR LIGAMENT** is on the posterior part of the inner surface of the external condyle. The **ONE FOR THE POSTERIOR LIGAMENT** is on the anterior part of the external surface of the inner condyle. The angle of the neck of femur with the shaft makes no changes after growth is completed.

BLOOD SUPPLY.—The head and neck of the femur receive branches from the sciatic, obturator and circumflex arteries. The trochanter receives twigs from the circumflex arteries. The nutrient vessel for the shaft is derived from second perforating; it enters near the linea aspera and is directed towards the head of the bone. Condyles are nourished by articular branches from the popliteal and the anastomotic of femoral.

OSSIFICATION.—From five centers. The one for the shaft is a **primary center** and begins to ossify in the **SEVENTH WEEK** of intra-uterine life. The other four are **epiphyseal centers**. The one for the lower extremity appears in the **NINTH MONTH** and joins the bone in the twentieth year. This is the only epiphysis which ossifies before birth, although some observers say the proximal end of the tibia ossifies before birth. The one for the head appears in the **FIRST YEAR** and joins the bone in the nineteenth year. The one for the greater trochanter appears the **FOURTH YEAR** and joins the bone in the eighteenth year. The one for the lesser trochanter appears in the **THIRTEENTH** or **FOURTEENTH YEAR** and joins the bone the seventeenth year.

ARTICULATES.—With three bones: os innominatum, tibia and patella.

ATTACHMENT OF MUSCLES.—Twenty-three. To the great trochanter, the Gluteus medius, Gluteus minimus, Pyriformis, Obturator externus, Obturator internus, Gemellus superior, Gemellus inferior, and Quadratus femoris. To the lesser trochanter, the Psoas magnus and the Iliacus below it. To the shaft, the Vastus externus, Gluteus maximus, short head of Biceps, Vastus internus, Adductor magnus, Pectineus, Adductor brevis, Adductor longus, Crureus and Suberureus. To the condyles, the Gastrocnemius, Plantaris and Popliteus.



DORSUM OF LEFT FOOT.

LESSON XL.

Tibialis anticus.—DESCRIPTION.—(Plate LXXV.)—The anterior tibial vessels and nerve run along the outer border of this muscle, which is just beneath the fascia on the outer side of the tibia. It is thick and fleshy above, but tendinous below where it passes through the innermost compartment of the anterior annular ligament.

ORIGIN.—(Plate LI.)—(1) Outer tuberosity of tibia; (2) upper two-thirds of shaft of tibia; (3) interosseous membrane adjoining; (4) deep surface of fascia; (5) intermuscular septum.

INSERTION.—(Plate LIII.)—Inner and under surface of internal cuneiform bone and base of metatarsal of great toe.

ACTION.—Flexes tarsus upon leg and assists in inverting the foot.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through anterior tibial.

BLOOD SUPPLY.—Anterior tibial artery.

Extensor propius hallucis.—DESCRIPTION.—(Plate LXXV.)—This muscle lies between the Tibialis anticus and Extensor longus digitorum. It is a thin, flat muscle and its tendon occupies its anterior border below. This tendon passes through a distinct compartment in the lower portion of the annular ligament, it also crosses the anterior tibial vessels near the ankle-joint and then lies on the inner side of these vessels. It gives a thin prolongation on each side of the metatarso-phalangeal articulation, which covers the surface of the joint.

ORIGIN.—(Plate LI.)—(1) Anterior surface of fibula, middle two-fourths of same; (2) part of interosseous membrane.

INSERTION.—(Plate LII.)—Base of last phalanx of great toe. It usually sends an expansion from the inner side of the tendon to be inserted into base of first phalanx.

ACTION.—Extends great toe and flexes tarsus.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through anterior tibial.

BLOOD SUPPLY.—Anterior tibial.

Extensor longus digitorum.—DESCRIPTION.—(Plate LXXV.)—This muscle lies external to the other muscles in this region. It is elongated and flattened. It and the Peroneus tertius enter the same canal in annular ligament. It divides into four slips, one for each of the four inner toes. A tendon from the Extensor brevis digitorum joins the three inner of these tendons on their outer side opposite the metatarso-phalangeal articulation. All four slips receive fibrous expansions from the Interossei and Lumbricales, after which they spread out into a broad aponeurosis which covers the dorsal surface of the first phalanx. This aponeurosis divides into three slips at the articulation of the first with the second phalanx.

ORIGIN.—(Plate LI.)—(1) Outer tuberosity of tibia; (2) upper three-fourths of anterior surface of shaft of fibula; (3) interosseous membrane; (4) deep surface of fascia; (5) intermuscular septa.

INSERTION.—(Plate LII.)—The middle slip is inserted into the base of the second phalanx; the two lateral slips, after uniting on the dorsal surface of the second phalanx, are continued onward and inserted into base of the third.

ACTION.—Extends toes and flexes foot.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through anterior tibial.

BLOOD SUPPLY.—Anterior tibial.

Peroneus tertius.—**DESCRIPTION.**—(Plate LXXV.)—This muscle is sometimes wanting, sometimes it is described as a fifth tendon of the Extensor longus digitorum with which it is joined, and their tendons pass through the same canal in the anterior annular ligament.

ORIGIN.—(Plate LI.)—(1) Lower fourth of anterior surface of fibula; (2) lower part of interosseous membrane; (3) intermuscular septum.

INSERTION.—(Plate LII.)—Inner side of dorsal surface at base of metatarsal of little toe.

ACTION.—Flexes and everts foot.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through anterior tibial.

BLOOD SUPPLY.—Anterior tibial.

Gastrocnemius.—**DESCRIPTION.**—(Plate LXXVII.)—The Gastrocnemius has two heads the inner of which is the larger. This muscle forms the greater part of the calf of the leg and is the most superficial one in this region. An aponeurosis spreads out from each tendon to cover the posterior part of that portion of the muscle to which it belongs. The muscular fibers of the outer head are thinner and do not extend as low as those of the inner. Muscular fibers are given off from the anterior surface of these tendinous expansions. This muscle gradually gets smaller and its tendon with that of the Soleus forms the tendo Achillis. In the tendon of the outer head there is a sesamoid fibro-cartilage (very seldom osseous); and one is occasionally found in the tendon of the inner head.

ORIGIN.—(Plate L.)—Inner and larger head from depression at upper and back part of inner condyle and from adjacent part of femur. The outer head from impression on outer side of external condyle and from posterior surface of femur immediately above the condyle. Both heads also arise by a few fibers from the ridges which are continued upward from the condyles to the linea aspera.

INSERTION.—(Plate LII.)—Os calcis by tendo Achillis.

ACTION.—Extends foot and flexes leg.

NERVE SUPPLY.—First and second sacral through internal popliteal (from great sciatic.)

BLOOD SUPPLY.—Popliteal.

Soleus.—**DESCRIPTION.**—(Plate LXXVII.)—Situated beneath the Gastrocnemius is the Soleus, which is a broad flat muscle. In shape it resembles a sole fish, hence its name. The deep transverse fascia of the leg, separates this muscle from the posterior vessels and nerve. As said before the tendon of this muscle and that of the Gastrocnemius make the tendo Achillis.

ORIGIN.—(Plate L.)—(1) Back part of head of fibula; (2) upper third of posterior surface of shaft of fibula; (3) oblique line of tibia; (4) middle third of internal border of tibia; (5) tendinous arch between the tibial and fibular origins, beneath which the popliteal vessels and internal popliteal nerve pass.

INSERTION.—(Plate LII.)—Os calcis by tendo Achillis.

ACTION.—Steadies leg on foot; prevents body from falling.

NERVE SUPPLY.—Internal popliteal and posterior tibial.

BLOOD SUPPLY.—Popliteal.

Plantaris.—**DESCRIPTION.**—(Plate LXXVII.)—This muscle is sometimes absent and again it may be double. It has the longest tendon of any muscle in the body. It takes its name because it is sometimes inserted into the plantar fascia. The muscular part of the Plantaris is a small fusiform belly about three or four inches in length. It is situated between the Gastrocnemius and Soleus and the tendon finally running along the inner side of the tendo Achillis. It may be lost in the fascia of the leg or the internal annular ligaments.

ORIGIN.—(Plate XLVIII.)—From the lower part of outer prolongation of linea aspera and from posterior ligament of knee-joint.

INSERTION.—(Plate LII.)—Os calcis with tendo Achillis.

ACTION.—Flexes leg and extends foot.

NERVE SUPPLY.—Internal popliteal.

BLOOD SUPPLY.—Popliteal.

LESSON XLI.

Popliteus.—**DESCRIPTION.**—(Plate LXXIX.)—This muscle forms part of the popliteal space. It is a thin flat triangular muscle, and is different from most other muscles in that its origin is smaller than its insertion. The internal popliteal nerve and the popliteal vessels cross the superficial surface of this muscle.

ORIGIN.—(Plate XLIX.)—Deep depression on outer condyle of femur and posterior ligament of knee.

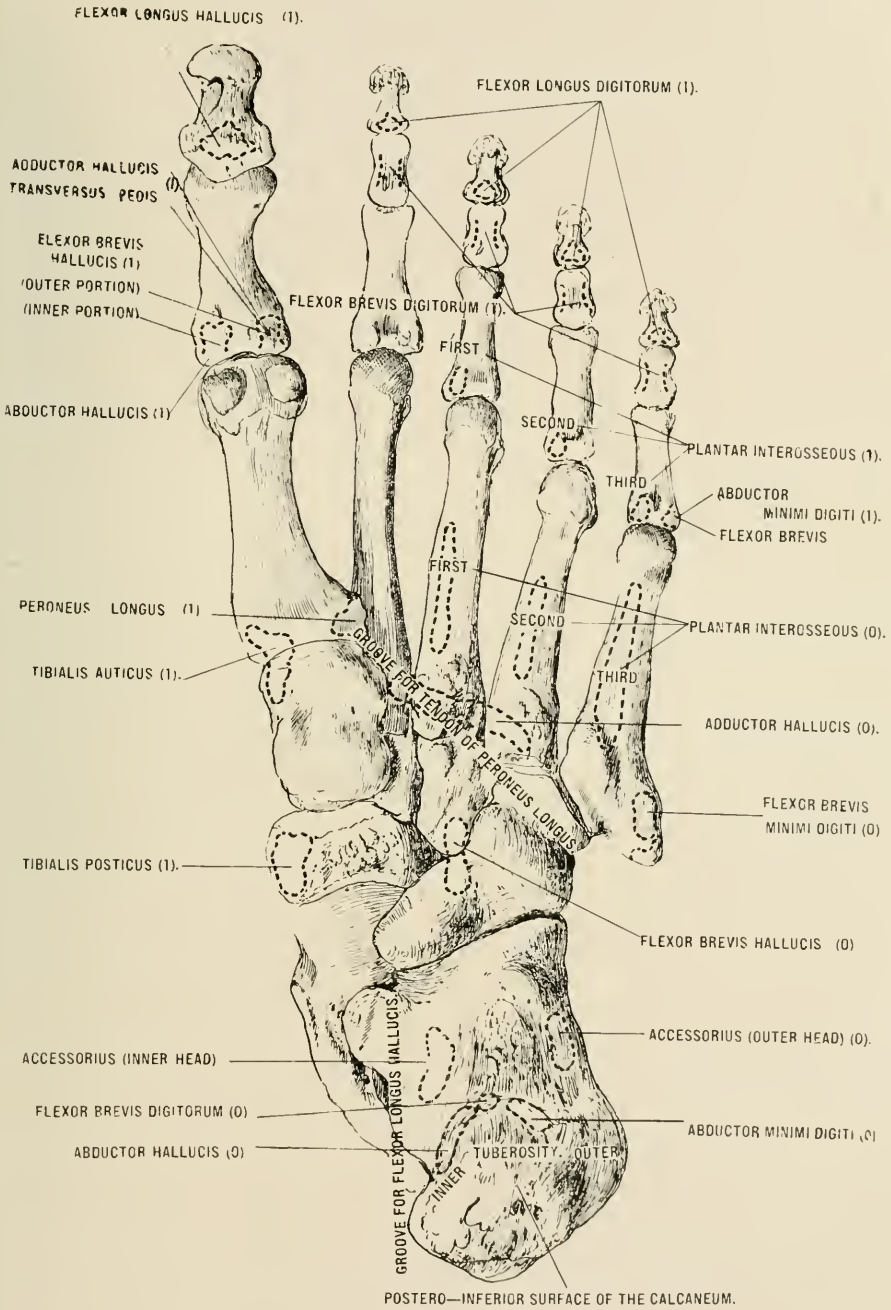
INSERTION.—(Plate L.)—Inner two-thirds of triangular surface above oblique line on posterior surface of shaft of tibia and tendinous expansion covering surface of muscle.

ACTION.—Flexes and rotates leg inward.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through internal popliteal.

BLOOD SUPPLY.—Popliteal.

Flexor longus hallucis.—**DESCRIPTION.**—(Plate LXXIX.)—This muscle is on the fibular side of the leg although it passes to the great toe. Its tendon occupies most all of the posterior surface of the muscle, then it passes through three grooves in three different bones. First one is on the posterior surface of the lower end of the tibia; the second one is on the posterior surface of the astragalus; and the third one is beneath the sustentaculum tali of the os calcis. The tendon finally passes between the two heads of the Flexor brevis hallucis to its insertion.



PLANTAR SURFACE OF LEFT FOOT.

ORIGIN.—(Plate L.)—(1) Lower two-thirds of posterior surface of shaft of fibula except an inch at lowest part; (2) lower part of interosseous membrane; (3) intermuscular septum; (4) fascia covering Tibialis posticus.

INSERTION.—(Plate LIII.)—Base of last phalanx of great toe.

ACTION.—Flexes great toe and extends foot.

NERVE SUPPLY.—Fifth lumbar and first and second sacral through posterior tibial.

BLOOD SUPPLY.—Posterior tibial.

Flexor longus digitorum.—**DESCRIPTION.**—(Plate LXXIX.)—This muscle is small at its origin but gradually increases in size as it descends. Its tendon occupies nearly all of the posterior surface of the muscle. The tendons of the Tibialis posticus and this muscle pass through a common groove behind the internal malleolus, but each tendon has its own synovial sheath. They are separated from each other by a fibrous septum. As the tendon crosses the sole of the foot obliquely forward and outward, it divides into four tendons each of which passes through the tendons of the Flexor brevis digitorum opposite the base of the first phalanx. Just before it divides it is joined by the Flexor accessorius.

ORIGIN.—(Plate L.)—Posterior surface of shaft of tibia, immediately below the oblique line to within three inches of its extremity internal to the tibial origin of the Tibialis posticus.

INSERTION.—(Plate LIII.)—Into bases of last phalanges of the four lesser toes.

ACTION.—Flexes toes and extends foot.

NERVE SUPPLY.—Fifth lumbar and first sacral through posterior tibial.

BLOOD SUPPLY.—Posterior tibial.

Tibialis posticus.—**DESCRIPTION.**—(Plate LXXIX.)—This muscle is the most deeply seated of all the muscles of the leg, and it lies between the Flexor longus hallucis and the Flexor longus digitorum. Between its two heads pass the anterior tibial vessels to the front of the leg. Its tendon passes through a groove behind the internal malleolus in its own sheath. It then passes through another sheath over the internal lateral ligament into the foot and then beneath the inferior calcaneo-navicular ligament to its insertion. It sends fibers of insertion to all the bones of the tarsus except the astragalus, also to second, third, and fourth metatarsal bones.

ORIGIN.—(Plate L.)—Whole of posterior surface of interosseous membrane, excepting lowest part; from outer portion of posterior surface of shaft of tibia, between commencement of oblique line above and junction of middle and lower third of shaft below; from upper two-thirds of the internal surface of fibula; some fibers also from deep transverse fascia and intermuscular septa.

INSERTION.—(Plate LIII.)—Tuberosity of navicular and internal cuneiform bones and bases of second, third, and fourth metatarsal.

ACTION.—Extends tarsus; turns sole inward.

NERVE SUPPLY.—Fifth lumbar and first sacral through posterior tibial.

BLOOD SUPPLY.—Posterior tibial.

Peroneus longus.—**DESCRIPTION.**—(Plate LXXIX.)—The Peroneus lon-

gus is superficial to the *Peroneus brevis*. It is situated at the upper part and outside of the leg. The external popliteal or peroneal nerve passes between the fibula and this muscle near the upper part of the bone between the head and the shaft. As its tendon passes behind the external malleolus it lies behind the tendon of the *Peroneus brevis* in a common groove which is converted into a canal by a fibrous band. These two tendons have synovial membranes. Its tendon passes across the outer side of the os calcis, below its peroneal tubercle, then it runs in a groove on the under surface of the cuboid bone after which it crosses the sole of the foot obliquely. Behind the external malleolus and on the outer side of the cuboid bone the tendon changes its direction, and in these places it is thickened. A sesamoid fibro-cartilage (sometimes a bone) is in its substance where it crosses the cuboid bone.

ORIGIN.—(Plate LI.)—(1) Head and upper two-thirds of outer surface of fibula; (2) deep surface of fascia; (3) intermuscular septa and occasionally by few fibers from outer tuberosity of tibia.

INSERTION.—(Plate LIII.)—Outer side of base of metatarsal of great toe and internal cuneiform. Occasionally sends slip to base of second metatarsal bone.

ACTION.—Extends and everts foot and steadies leg upon foot.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through musculocutaneous branch of the external popliteal.

BLOOD SUPPLY.—Peroneal.

Peroneus brevis.—**DESCRIPTION.**—(Plate LXXIX.)—This muscle is shorter and smaller than the *Peroneus longus* and lies behind it. Its tendon passes behind the external malleolus in front of that of the *Peroneus longus*. On the outer side of the os calcis it is separated from the tendon of the *Peroneus longus* by the peroneal tubercle.

ORIGIN.—(Plate L.)—Lower two-thirds of external surface of shaft of fibula, and intermuscular septa.

INSERTION.—(Plate LIII.)—Tuberosity at base of metatarsal of little toe on its outer side.

ACTION.—Extends foot and helps to steady leg upon foot.

NERVE SUPPLY.—Fourth and fifth lumbar and first sacral through musculocutaneous branch of external popliteal.

BLOOD SUPPLY.—Peroneal.

LESSON XLII.

Extensor brevis digitorum.—**DESCRIPTION.**—(Plate LXXV.)—This is a broad, thin muscle which passes obliquely across the dorsum of the foot and divides into four tendons. Beneath this muscle lie the tarsal and metatarsal arteries and bones and the Dorsal interossei muscles. The innermost tendon crosses the dorsalis pedis artery.

ORIGIN.—(Plate LII.)—(1) Fore part of upper and outer surface of os calcis; (2) external calcaneo-astragaloid ligament; (3) horizontal portion of anterior annular ligament.

INSERTION.—(Plate LIII.)—Innermost tendon into dorsal surface of base of first phalanx of great toe; the other three into outer sides of long extensor tendons of second, third and fourth toes.

ACTION.—Extends phalanges of four inner toes acting only on first phalanx of the great toe.

NERVE SUPPLY.—Anterior tibial.

BLOOD SUPPLY.—Dorsalis pedis.

Abductor hallucis.—**DESCRIPTION.**—(Plate LV.)—This muscle is the inner one of the three muscles of the first layer of the plantar surface of the foot. It is protected by the plantar fascia. This fascia is beneath the muscle when one's foot is on the floor.

ORIGIN.—(Plate LIII.)—(1) Inner tubercle of under surface of os calcis; (2) internal annular ligament; (3) plantar fascia; (4) intermuscular septum.

INSERTION.—(Plate LIII.)—Inner side of base of first phalanx of great toe.

ACTION.—Abducts great toe; flexes proximal phalanx.

NERVE SUPPLY.—Internal plantar.

BLOOD SUPPLY.—Internal plantar.

Abductor minimi digiti.—**DESCRIPTION.**—(Plate LV.)—This muscle is separated from the Flexor brevis digitorum by a vertical septum of fascia, and has along its inner border the plantar vessels and nerve. All the muscles of the first layer of the foot bear the same relation to the plantar fascia.

ORIGIN.—(Plate LIII.)—(1) Outer tubercle of os calcis; (2) under surface of os calcis in front of both tubercles; (3) fore part of inner tubercle; (4) plantar fascia; (5) intermuscular septum.

INSERTION.—(Plate LIII.)—Its tendon, after gliding over a smooth facet on the under surface of the base of the fifth metatarsal bone, is inserted, together with the short Flexor of the little toe, into the outer side of base of first phalanx of little toe.

ACTION.—Abducts little toe; flexes proximal phalanx.

NERVE SUPPLY.—External plantar.

BLOOD SUPPLY.—External plantar.

Flexor brevis digitorum.—(Perforatus.)—**DESCRIPTION.**—(Plate LV.)—This muscle is called Perforatus because its tendons are perforated by those of the Flexor longus digitorum (Perforans.) After the muscle divides into four tendons, one for each of the four outer toes, these tendons themselves divide opposite bases of the first phalanges for the passage of the tendons of the Flexor longus digitorum. They divide a second time to be inserted into the sides of the second phalanx of the four outer toes. This muscle is separated from the external plantar vessels and nerve by a thin layer of fascia.

ORIGIN.—(Plate LIII.)—(1) Inner tubercle of os calcis; (2) central part of plantar fascia; (3) intermuscular septa.

INSERTION.—(Plate LIII.)—Sides of second phalanges of four lesser toes.

ACTION.—Flexes toes.

NERVE SUPPLY.—Internal plantar.

BLOOD SUPPLY.—Plantar arteries.

Adductor obliquus hallucis.—**DESCRIPTION.**—(Plate LX.)—This muscle

PHALANXES. TWO CENTERS FOR EACH BONE. ONE FOR SHAFT. ONE FOR METATARSAL EXTREMITY.

THE CENTERS FOR THE BASE OF THE TERMINAL PHALANXES APPEAR AT THE SIXTH YEAR. CONSOLIDATE AT THE EIGHTEENTH YEAR.

THE CENTERS FOR THE HEADS OF THE METATARSALS APPEAR AT THE THIRD YEAR, AND CONSOLIDATE AT THE TWENTIETH YEAR.



METATARSUS
TWO CENTERS FOR EACH BONE.
ONE FOR SHAFT ONE FOR DIGITAL
EXTREMITY EXCEPT FIRST

THE CENTER FOR THE EPIPHYSIS
FOR THE METATARSAL OF THE HALLUX
APPEARS AT THE THIRD YEAR.
CONSOLIDATES AT THE TWENTIETH YEAR.

TARSUS.

ONE CENTER FOR EACH BONE. EXCEPT OS CALCIS

THE CENTER FOR THE EPIPHYSIS FOR THE CAL-
CANEUM APPEARS AT THE TENTH YEAR. CONSOLIDATES
AT SIXTEENTH YEAR.

SHOWING THE DIRECTION OF NUTRIENT ARTERIES OF BONES OF THE FOOT.

occupies the hollow space between the four inner metatarsal bones. It is a large, thick, fleshy mass passing obliquely across the foot.

ORIGIN.—(Plate LIII.)—Tarsal extremities of second, third, and fourth metatarsals and sheath of tendon of *Peroneus longus*.

INSERTION.—(Plate LIII.)—Outer side of base of first phalanx of great toe, with outer portion of *Flexor brevis hallucis*. All the small muscles of the great toe give off fibrous expansions at their insertion to blend with the long extensor tendon.

ACTION.—Abducts great toe.

NERVE SUPPLY.—External plantar.

BLOOD SUPPLY.—Plantar arteries.

Adductor transversus hallucis.—**DESCRIPTION.**—(Plate LX.)—This muscle is narrow and flat, and crosses the heads of metatarsal bones, lying between them and the flexor tendons. Another name for this muscle is (*Transversus pedis*.)

ORIGIN.—(Plate LIII.)—Inferior metatarso-phalangeal ligaments of three outer toes.

INSERTION.—(Plate LIII.)—Outer side of first phalanx of great toe, its fibers being blended with the tendon of insertion of the *Adductor obliquus hallucis*.

ACTION.—Adducts great toe.

NERVE SUPPLY.—External plantar.

BLOOD SUPPLY.—External plantar.

Dorsal interossei.—**DESCRIPTION.**—(Plate LXI.)—The Dorsal interossei of the foot are similar to those in the hand with the exception that they are grouped around the middle line of the second toe, while those of the hand are grouped around the middle line of the middle finger. Each one has two heads between which pass the perforating arteries to the dorsum of the foot, except in the First dorsal interosseous between the two heads of which passes the communicating branch of the *dorsalis pedis* artery.

ORIGIN.—(Plate LXI.)—From adjacent sides of metatarsal bones.

INSERTION.—(Plate LXI.)—Bases of first phalanges and aponeurosis of common extensor tendon; first muscle inserted into inner side of second toe, the other three into outer side of second, third, and fourth toes.

ACTION.—Flex first and extend second and third phalanges; adduct second, third, and fourth toes.

NERVE SUPPLY.—External plantar. First and second dorsal also receive extra filaments from anterior tibial nerve.

BLOOD SUPPLY.—The Plantar interossei receive the external plantar, and the Dorsal interossei receive the plantar arteries both external and internal; except the third dorsal interosseous which receives the external only.

Plantar interossei.—**DESCRIPTION.**—(Plate LXII.)—The plantar interossei are three in number, the same as the palmar interossei of the hand and also have one head apiece. They lie beneath the metatarsal bones.

ORIGIN.—(Plate LXII.)—Base and inner side of shaft of third, fourth, and fifth metatarsal bones.

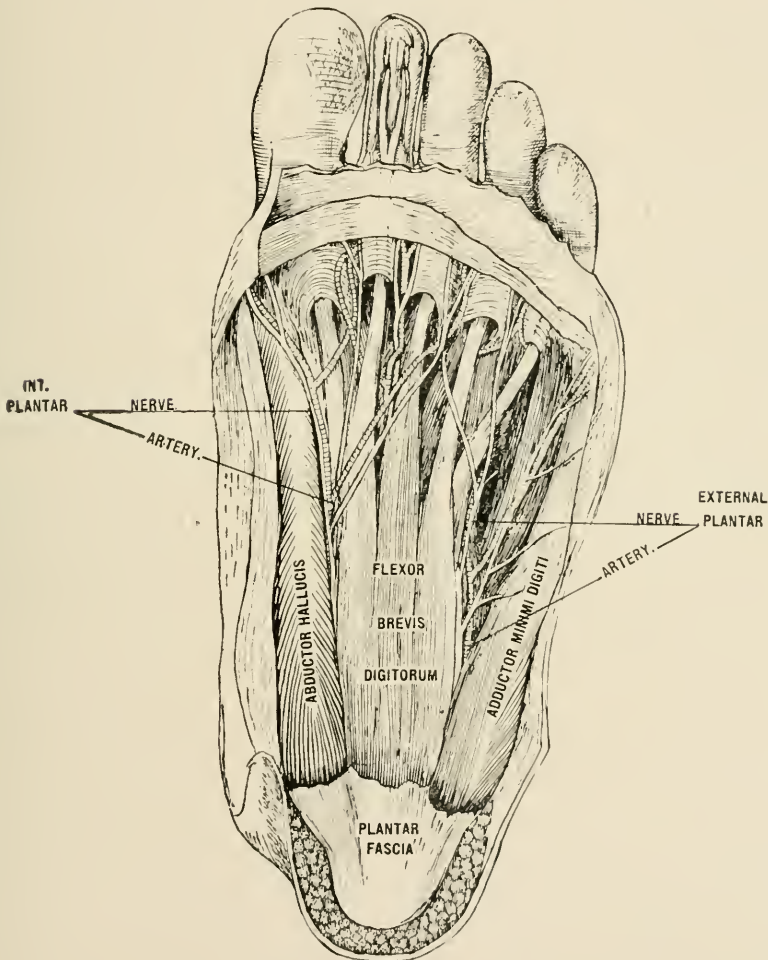
INSERTION.—(Plate LXII.)—Inner sides of bases of first phalanges of same toes and aponeurosis of common extensor tendon.

ACTION.—Adduct first phalanges of three outer toes; also flex first phalanges, but extend the rest.

NERVE SUPPLY.—External plantar.

BLOOD SUPPLY.—Plantar arteries.

PLATE LV.



PLANTAR FASCIA AND FIRST LAYER OF MUSCLES OF FOOT.

LESSON XLIII.

Flexor accessorius.—DESCRIPTION.—(Plate LIX.)—The two heads of this muscle are separated from each other by the long plantar ligament. The external plantar vessels and nerve lie beneath it, when one is standing.

ORIGIN.—(Plate LIII.)—Inner or larger head from inner concave surface of os calcis below groove for tendon of Flexor longus hallucis. Outer head from outer surface of os calcis and long plantar ligament.

INSERTION.—(Plate LIX.)—Outer margin, upper and under surfaces of tendon of Flexor longus digitorum.

ACTION.—Assists long flexors of toes.

NERVE SUPPLY.—External plantar.

BLOOD SUPPLY.—External plantar.

Lumbricales.—**DESCRIPTION.**—(Plate LIX.)—These are accessory to tendons of the Flexor longus digitorum.

ORIGIN.—(Plate LIX.)—Tendons of long flexors.

INSERTION.—(Plate LIX.)—Expansion of long extensors and base of first phalanx of corresponding toe.

ACTION.—Accessory to flexors and extensors.

NERVE SUPPLY.—Two inner muscles get the internal plantar. Two outer muscles get the external plantar.

NOTE.—The first inner lumbricalis has internal plantar and the three outer have external plantar in one out of ten cases.

BLOOD SUPPLY.—Plantar arteries.

Flexor brevis hallucis.—**DESCRIPTION.**—(Plate LX.)—This muscle has one origin and two insertions, and is situated along the inner and under surfaces of the metatarsal of the great toe. The inner tendon joins that of the Abductor hallucis, while the outer one joins the tendons of the Adductor transversus hallucis and the Adductor obliquus hallucis prior to their common insertion in a sesamoid bone. Between these two heads the Flexor longus hallucis lies in a groove.

ORIGIN.—(Plate LIII.)—(1) Inner border of cuboid bone; (2) external cuneiform; (3) prolongation of tendon of Tibialis posticus.

INSERTION.—(Plate LIII.)—Inner and outer sides of base of first phalanx of great toe.

ACTION.—Flexes and abducts great toe.

NERVE SUPPLY.—Internal plantar.

BLOOD SUPPLY.—Internal plantar.

Astragalus, supplied by dorsalis pedis. One or two centers of ossification.

ARTICULATION.—With four bones: (1) tibia, (2) fibula; (3) os calcis, and navicular.

Astragalus has no muscles attached.

Os calcis, supplied by posterior tibial, internal and external malleolar. Two centers of ossification. For ossification of tarsus see Plate LIV.

ARTICULATION.—With two bones: (1) the astragalus and (2) cuboid.

ATTACHMENT OF MUSCLES.—Eight: (1) part of the Tibialis posticus; (2) the tendon Achillis; (3) Plantaris; (4) Abductor hallucis; (5) Abductor minimi digiti; (6) Flexor brevis digitorum; (7) Flexor accessorius, and (8) Extensor brevis digitorum.

Cuboid, supplied by the dorsalis pedis, as are the remaining bones of tarsus.

OSSIFICATION.—One center.

ARTICULATION.—With four bones; (1) the os calcis; (2) external cuneiform, and (3) the fourth and (4) fifth metatarsal bones; occasionally with the navicular.

ATTACHMENT OF MUSCLES.—(1) part of the Flexor brevis hallucis and (2)

PLATE LVI.



FIRST LAYER OF MUSCLES OF THE FOOT, ALSO INTERNAL AND EXTERNAL PLANTAR ARTERIES.

a slip from the tendon of the Tibialis posticus.

Navicular, supplied by dorsalis pedis.

OSSIFICATION.—One center.

ARTICULATION.—With four bones; (1) astragalus and three cuneiform; occasionally the cuboid.

ATTACHMENT OF MUSCLES.—Part of the Tibialis posticus.

Internal cuneiform, supplied by dorsalis pedis.

OSSIFICATION.—One center.

ARTICULATION.—With four bones: (1) navicular, (2) middle cuneiform; (3) first and (4) second metatarsal bones.

ATTACHMENT OF MUSCLES.—(1) Tibialis anticus and (2) posticus and (3) Peroneus longus.

Middle cuneiform, supplied by dorsalis pedis.

OSSIFICATION.—One center.

ARTICULATION.—With four bones, navicular, internal and external cuneiform and second metatarsal bone.

ATTACHMENT OF MUSCLES.—A slip from the tendon of the Tibialis posticus is attached to this bone.

External cuneiform, supplied by dorsalis pedis.

OSSIFICATION.—One center.

ARTICULATION.—With six bones; the navicular, middle cuneiform, cuboid, second, third, and fourth metatarsal bones.

ATTACHMENT OF MUSCLES.—Two: part of Tibialis posticus, Flexor brevis hallucis.

METATARSUS. Plates LII-LIII.

BLOOD SUPPLY.—They all have small nutrient branches from interosseous.

OSSIFICATION.—Each metatarsal bone has two centers. Plate LIV.

ARTICULATION.—Each bone articulates with the tarsal bones by one extremity, and by the other with the first row of phalanges. The number of tarsal bones with which each metatarsal articulates is one for the first, three for the second, one for the third, two for the fourth, and one for the fifth.

ATTACHMENT OF MUSCLES.—To the **first metatarsal bone**, three, part of the Tibialis anticus, the Peroneus longus, and First dorsal interosseous. To the **second**, four, the Adductor obliquus hallucis and First and Second dorsal interosseous, and slip from the tendon of the Tibialis posticus, and occasionally a slip from the Peroneus longus. To the **third**, five, the Adductor obliquus hallucis, Second and Third dorsal and First plantar interosseous, and a slip from the tendon of the Tibialis posticus. To the **fourth**, five, the Adductor obliquus hallucis, Third and Fourth dorsal, and Second plantar interosseous, and a slip from the tendon of the Tibialis posticus. To the **fifth**, six, the Peroneus brevis Peroneus tertius, Flexor brevis minimi digiti, Adductor transversus hallucis, Fourth dorsal and Third plantar interosseous.

PHALANGES. Plates LII-LIII.

BLOOD SUPPLY.—They all have small nutrient branches from digital.

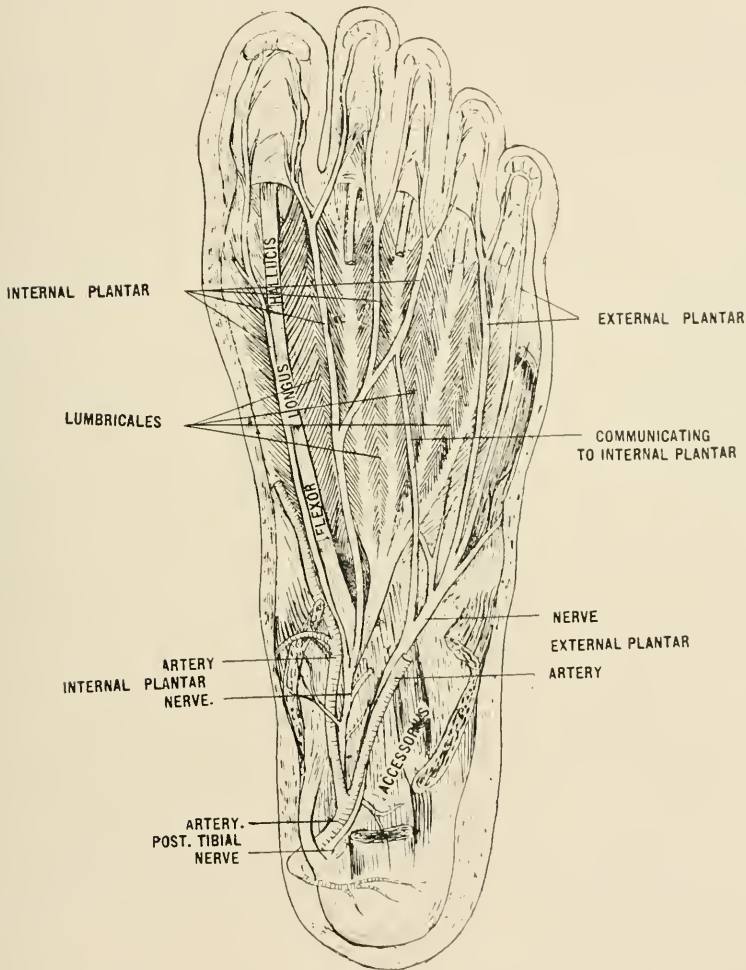
OSSIFICATION.—From two centers. Plate LIV.

ARTICULATION.—The first row, with the metatarsal bones behind and second phalanges in front; the second row of the four outer toes, with the first and third phalanges; of the great toe, with the first phalanx; the third row of the four outer toes, with the second phalanges.

ATTACHMENT OF MUSCLES.—To the **first phalanges**. **Great toe**, five muscles; innermost tendon of Extensor brevis digitorum, Abductor hallucis, Adductor obliquus hallucis, Flexor brevis hallucis, Adductor transversus hallucis.

Second toe, three muscles; First and Second dorsal interosseous and First lumbrical. **Third toe**, three muscles; Third dorsal and First plantar interosseous and Second lumbrical. **Fourth toe**, three muscles; Fourth dorsal and Second plantar interosseous and Third lumbrical. **Fifth toe**, four muscles; Flexor brevis minimi digiti. Abductor minimi digiti, and Third plantar interosseous, and

PLATE LVII.



LUMBRICALES, INTERNAL AND EXTERNAL PLANTAR VESSELS AND NERVES.

Fourth lumbrical. **Second phalanges. Great toe;** Extensor longus hallucis, Flexor longus hallucis. **Other toes;** Flexor brevis digitorum; one slip of the common tendon of the Extensor longus and brevis digitorum. **Third phalanges:** two slips from the common tendon of the Extensor longus and Extensor brevis digitorum, and the Flexor longus digitorum.

LESSON XLIV.

THE TIBIA.

The **word** tibia means flute. It is also called the shin bone and is situated on a plane anterior to and on the inner side of the fibula. It articulates with the femur above, the astragalus below, and the fibula externally. It sustains the weight of the entire body above the knee-joint as the fibula does not enter into this articulation.

The **superior expanded portion** is called the head, each side of which is a tuberosity. These tuberosities are continuous in front but are separated behind by the popliteal notch. The upper surface of each tuberosity is concave to receive the condyles of the femur.

The **internal tuberosity** is larger than the external one, and its articular surface is more concave and longer. A horizontal groove for the Semimembranosus muscle is behind this articular surface close to its inner border.

The **external tuberosity** gives attachment to the ilio-tibial band at the junction of the anterior and outer surfaces, at which place there is a prominent tubercle. The Extensor longus digitorum and the Biceps have a few fibers of attachment immediately below and in front. The fibula articulates with the posterior and under part in a flat facet which looks downward, outward, and backward. The articular surface of this tuberosity is concave from side to side, but convex from before backward, and its circumference is almost circular. The semilunar fibro-cartilages are situated around the circumference of each of these articular surfaces where they are flattened.

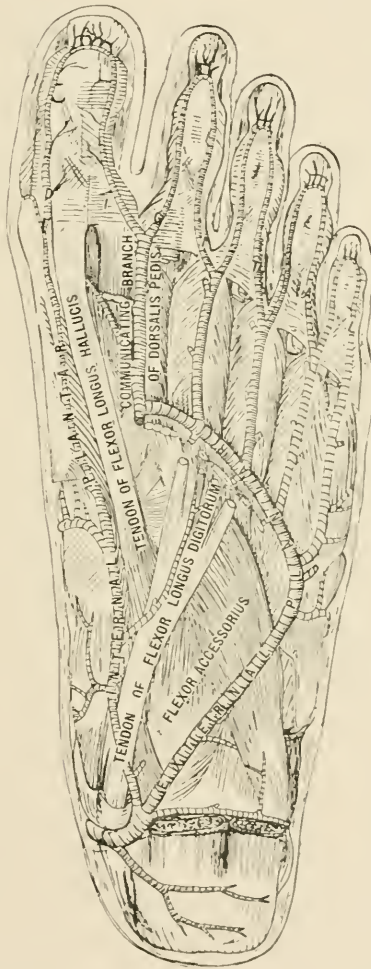
The **spine** is an elevation between these articular surfaces. The summit of the spine has two tubercles with an intervening space. The depressions in front and behind the spine are for the attachment of the crucial ligaments. This posterior depression is continuous into the popliteal notch, which separates the tuberosities posteriorly. The **anterior tuberosity** or **tubercle** is at the junction of the head and the shaft anteriorly. The lower half of this tubercle gives attachment to the ligamentum patellæ.

The **shaft** which is triangular on cross section is smallest at the junction of the upper two-thirds with the lower one-third. It has three borders and three surfaces. The **anterior border** separates the internal and external surfaces and extends from the anterior tuberosity or tubercle to the front of the inner malleolus. The **crest** of the tibia is the upper two-thirds of this border. The lower one-third of this border is smooth. The **internal border** separates the internal and posterior surfaces. It commences above at the back of the inner tuberosity and extends below to the posterior border of the internal malleolus. This border is most distinct in the middle third of the bone. The **external border**, also called interosseous ridge, separates the external and posterior surfaces. It gives attachment to the interosseous membrane and is thin and sharp in its middle portion.

The **internal surface** is nearly subcutaneous and is convex. The insertion

of the Gracilis is at the inner side of the tubercle, having the insertion of the Semitendinosus below it, the two being surrounded by the double insertion of the Sartorius, except below. The **external surface** has on its upper two-thirds, which is concave, the Tibialis anticus. The lower part of its surface runs forward and is covered by the extensor tendons. The **posterior surface** has an

PLATE LVIII.



ACCESSORIUS MUSCLE AND PLANTAR VESSELS.

oblique line running down and inward at the junction of the upper and middle one-third of the bone. This line gives the origin of the Soleus. The popliteus muscle is attached to the triangular area above this line. The **MIDDLE ONE-THIRD** of the bone is divided into two portions by a longitudinal ridge, the inner one of which is for the origin of the Flexor longus digitorum, and the outer one

is for the origin of the *Tibialis posticus*. A nutrient foramen is on this portion of the bone and is directed towards the distal extremity.

The **lower portion** of the bone is broad transversely, and extends downward internally to form the inner malleolus. On the posterior portion of this malleolus is a groove for the tendon of the *Tibialis posticus*, and externally to this is one for the tendon of the *Flexor longus hallucis*. The fibula articulates with the external portion of the lower extremity of the bone in a concave surface, which is rough for the attachment of ligaments, except along its lower border. The lower end of the tibia has an articular surface which is concave, being broader in front than behind. It articulates with the astragalus. In the middle of this surface is a slight elevation separating two lateral depressions.

The **tibia** is a very vascular bone. The nutrient artery for the shaft is furnished by the posterior tibial, it enters the bone near the interosseous border at the junction of the upper and middle third, and is directed downward. The head of the bone receives numerous branches from the inferior articular arteries of the popliteal, and the recurrent branches of the anterior and posterior tibial arteries. The lower extremity receives twigs from the posterior and anterior tibial, the anterior peroneal, and the internal malleolar arteries.

OSSIFICATION.—From three centers. The center for the shaft appears in the eighth week of intra-uterine life. The center for the proximal extremity appears at the end of the ninth month of intra-uterine life, and joins the shaft at the twenty-first year or even later. The center for the distal extremity appears during the second year and unites with the shaft at the eighteenth year.

ARTICULATION.—With three bones; femur, fibula and astragalus.

ATTACHMENT OF MUSCLES.—Twelve; to the inner tuberosity, the *Semi-membranosus*; to the outer tuberosity, the *Tibialis anticus* and *Extensor longus digitorum* and *Biceps*; to the shaft, its internal surface, the *Sartorius*, *Gracilis*, and *Semitendinosus*; to its external surface, the *Tibialis anticus*; to its posterior surface, the *Popliteus*, *Soleus*, *Flexor longus digitorum*, and *Tibialis posticus*; to the tubercle, the *ligamentum patellæ*.

LESSON XLV.

THE PATELLA.

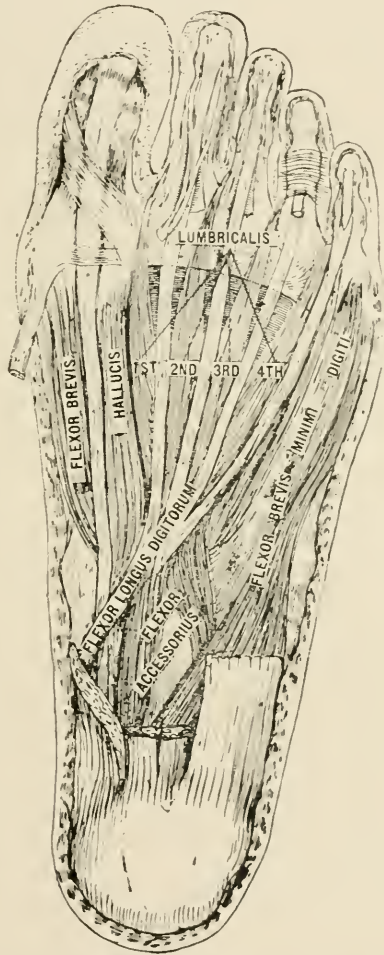
The **sesamoid bone** which is developed in the tendon of the *Quadriceps extensor* muscle is the patella (knee-pan.) Its anterior surface is pierced by vascular foramina. Its superior border has the *Rectus* and *Crureus* attached to it. The posterior margin of this border is higher than the anterior margin.

The external part of the posterior surface is concave transversely, and the internal part is convex. When the leg is **EXTENDED** the lower one-sixth of articular surface is in contact with the femur. When it is **MID-FLEXED** the middle three-sixths of the articular surface is in contact with the femur. When **FULLY FLEXED** the upper two-sixths of the articular surface is in contact with the femur, also in this position the marginal facet is in contact with the inner condyle. The **ligamentum patellæ** springs from the apex. If the patella is placed upon a

plain surface, its apex away from you and its anterior surface up, it will tip to the side to which it belongs.

BLOOD SUPPLY.—The patella receives twigs from the superficial branch of the anastomotica, anterior tibial recurrent, and the inferior articular of the popliteal.

PLATE LIX.



FLEXOR LONGUS DIGITORUM TENDON AND FOUR LUMBRICALES.

OSSIFICATION.—One center. It begins during the third year and is completed about the age of puberty.

ARTICULATION.—With two condyles of femur.

ATTACHMENT OF MUSCLES.—Four; the Rectus, Crureus, Vastus internus, and Vastus externus. These muscles, joined at their insertion, constitute the Quadriceps extensor cruris.

THE FIBULA.

The **word** fibula means clasp or pin. It is also called the peroneal bone, and lies almost parallel with the tibia. It is not quite as long as the tibia, but extends to a lower level. Its main purpose is to give elasticity to the leg.

Its **upper expanded portion** is called the head, which is prolonged upward at its posterior part into the **STYLOID PROCESS**. The inner surface of the head and styloid process has a facet which looks upward, inward, and forward to articulate with the tibia. This styloid process gives attachment to the Biceps. The Soleus muscle is attached behind and the Peroneus longus is attached in front. The **NECK** is the constricted part below the head. The **lower extremity** extends into the external malleolus which is lower than the internal malleolus. Man is the only animal in which this is true. It articulates with the astragalus internally, and behind there is a depression for the posterior fasciculus of the external lateral ligament. There is a slight groove posteriorly for the Peroneus longus and brevis. This extremity is convex and subcutaneous externally.

The **shaft** has four surfaces which are **ANTERIOR, INTERNAL, POSTERIOR, and EXTERNAL**; and it has four borders which are **ANTERO-EXTERNAL, ANTERO-INTERNAL, POSTERO-EXTERNAL, and POSTERO-INTERNAL**. To its **anterior surface** are attached the Extensor proprius hallucis, Extensor longus digitorum, and Peroneus tertius. This surface is broad and grooved below but narrow above. The **internal surface** is grooved for the Tibialis posticus. The **posterior surface** has attached to its upper third the Soleus, below this the Flexor longus hallucis. The nutrient canal is on this surface and is directed downward. The Peroneus brevis and longus are attached to the external surface, which is directed outward above and backward below.

The **antero-external border** is between the peroneal muscles and the extensor muscles, and extends from the front of the head of the fibula to the external malleolus, where it divides to embrace a triangular subcutaneous surface. The **antero-internal border**, called **interosseous ridge**, gives attachment to the interosseous membrane and separates the extensor muscles in front from the Tibialis posticus behind. It lies parallel with the antero-external border in its upper third. It ends below just above the articular facet. The **postero-external border** separates the peroneal muscles from the flexor muscles. It commences at the base of the styloid process and ends below in the posterior border of the external malleolus. This is not a straight line for at first it is directed outward, then backward, then inward. The **postero-internal border**, called the **oblique line**, commences above the inner side of the heads and ends below in the lower one-fourth of the bone where it joins the interosseous ridge, or antero-internal border.

BLOOD SUPPLY.—The fibula receives the nutrient artery of its shaft from the peroneal branch of the posterior tibial. The head is nourished by branches from the inferior external articular branch of the popliteal artery, and the malleolus is supplied mainly by the peroneal and external malleolar arteries.

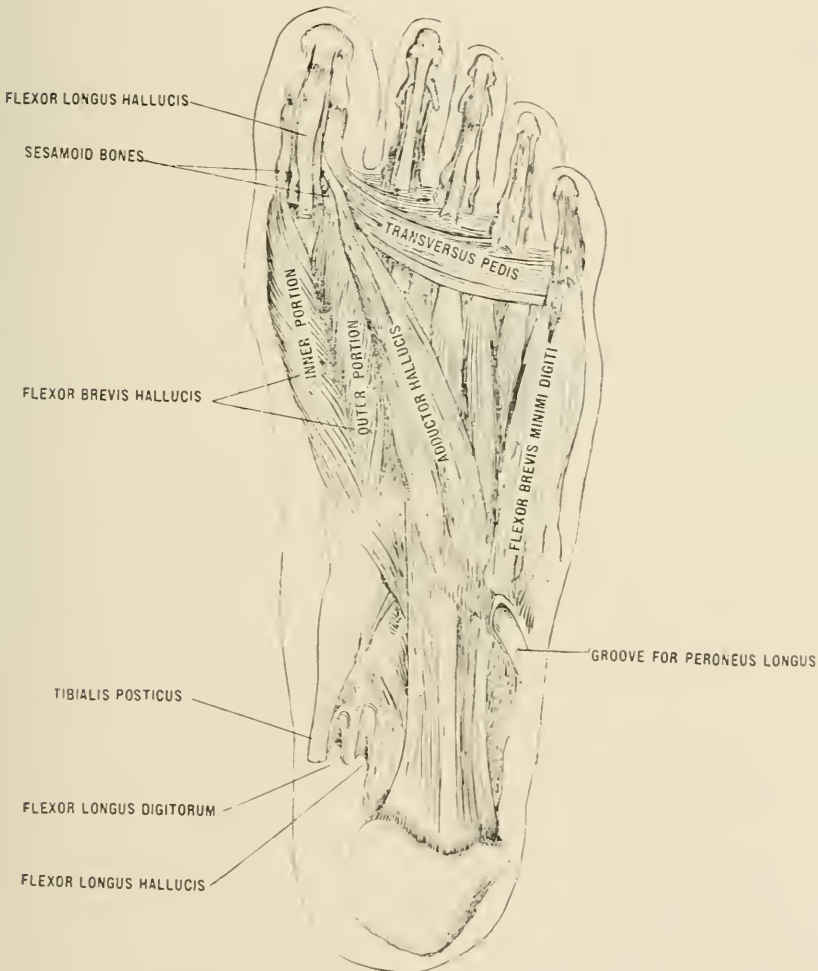
OSSIFICATION.—From three centers. The center for the shaft appears in the eighth week of intra-uterine life. The center for the proximal extremity

appears in the fourth or fifth year, and joins the shaft at the twenty-second year or later. The center for the distal extremity appears during the second year, and unites with the shaft at the twentieth year.

ARTICULATION.—With two bones: the tibia and the astragalus.

ATTACHMENT OF MUSCLES.—Nine; to the head, the Biceps, Soleus, and

PLATE LX.



THIRD LAYER OF MUSCLES OF THE FOOT.

Peroneus longus; to the shaft, its anterior surface, the Extensor longus digitorum, Peroneus tertius, and Extensor proprius hallucis; to the internal surface, the Tibialis posticus; to the posterior surface, the Soleus and Flexor longus hallucis; to the external surface, the Peroneus longus and brevis.

The FIBULA is a vestigial bone in man and survives mainly on account of the excessive development of its malleolus. This accounts for the fact that the

lower epiphysis, through appearing first, unites with the shaft before the upper epiphysis. In birds, the head of the bone is large, and enters into the formation of the knee-joint, while the lower end atrophies. The rule is this: Those ephyses which are the last to form are first to join the bone. The fibula is an exception. Rule 1, page 19.

LESSON XLVI.

ARTERIES

The **abdominal aorta** (Plates LXXII-XC) divides into the right and left common iliac arteries a little to the left side of the median line of the fourth lumbar vertebra. This division is on a level with the highest points of the crest of the ilii. Each of these common iliac arteries divides into an external and an internal iliac branch at the lumbo-sacral joint. The branches of these common iliac arteries supply the peritoneum, ureter, Psoas magnus.

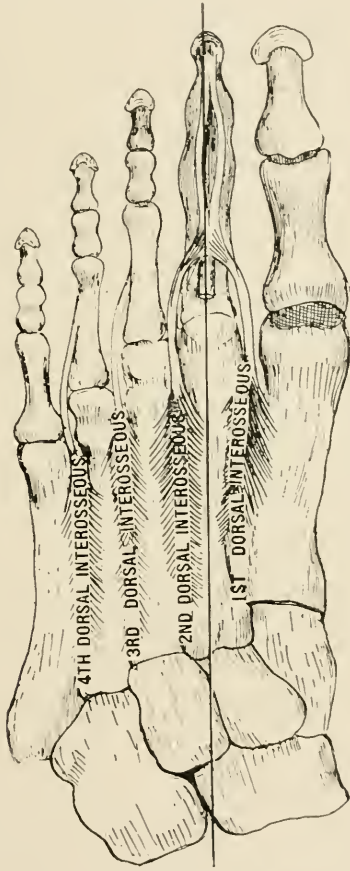
The **internal iliac branch** (Plates LXXII-XCI) is about an inch and a half long and divides into an anterior and posterior trunk at the upper margin of the great sacro-sciatic foramen. The posterior trunk gives off the three following branches: (1) **Ilio-lumbar**, (2) **lateral sacral**, (3) **gluteal**. The **ilio-lumbar branch** divides into an iliac branch for the Iliacus muscle and the ilium and a lumbar branch for the Psoas magnus and Quadratus lumborum. The branch to the Quadratus lumborum sends a spinal branch to the spinal cord through the last intervertebral foramen. The **lateral sacral branch** divides into a superior and inferior division. The superior one, after anastomosing with the sacro-media, passes through the first or second anterior sacral foramen to supply the canal, after which it passes through the corresponding posterior foramen to the back. The inferior branch, after descending on the sacrum and coccyx, anastomoses with the sacro-media and has a similar route as the superior branch.

The **gluteal branch** passes out of the pelvis through the great sacro-sciatic foramen, above the Piriformis muscle. While in the pelvis, it gives branches to the ilium and adjacent muscles. Outside of the pelvis it divides into superficial branch which passes under the Gluteus maximus, and deep branch which passes between the Gluteus medius and Gluteus minimus, and then divides into an upper branch which runs along the upper border of the Gluteus minimus, and a lower branch which runs downward.

The **anterior trunk** (Plates LXXII-XC) gives off the following branches: (1) Superior vesical, (2) middle vesical, (3) inferior vesical, (4) middle hemorrhoidal, (5) obturator, (6) internal pudic, (7) sciatic; and in the female (8) uterine, and (9) vaginal. The **superior vesical branch** is that portion of the fetal hypogastric artery which is still used after birth. It runs to the side of the bladder and gives off the artery to the vas deferens, which artery runs with the spermatic cord. In the fetus the external iliac artery is only about one-half as large as this hypogastric artery (umbilical). This artery in the fetus runs to the bladder and from there along the abdominal wall to pass through the

umbilicus to the umbilical cord and the placenta, (Plate IX). The **middle vesical branch** passes to the base of the bladder and is generally a branch of the superior vesical. The **inferior vesical branch** runs to the base of the bladder, prostate gland and seminal vesicles in the male and to the vagina, rectum, and neck of the bladder in the female. In the female it is called vaginal. The **middle hemorrhoidal branch** passes to the rectum and generally arises with the

PLATE LXI.



THE FOUR DORSAL INTEROSSEI.

inferior vesical. The **obturator branch** lies inferior to the obturator nerve, and after passing through the obturator canal it divides into an internal and an external branch, which branches wind around either margin of the obturator foramen under the Obturator externus muscle. This branch arises from the deep epigastric once in three and a half cases, and passes over the outer margin of the femoral ring to the obturator foramen. Inside the pelvis it sends branches to the Iliacus muscle and iliac fossa, branches to the bladder, and pubic branches to the back of the os pubis. The **internal pudic branch** is the smaller of the terminal branches of the anterior trunk, and passes out of the pelvis below the

Pyriformis muscle, lying between this muscle and the Coccygeus. After crossing the spine of the ischium, external to the nerve, it passes through the lesser sacro-sciatic foramen into the pelvis, it now passes through Alcock's canal about an inch and a half above the tuberosity of the ischium, it now pierces the triangular ligament where it divides into the dorsal artery of the penis and the artery of the corpus cavernosum. Besides these two terminal branches it has the (1) muscular, (2) inferior hemorrhoidal, (3) superficial perineal, (4) transverse perineal, (5) artery of the bulb. The **sciatic branch** is the larger of the terminal branches of the anterior trunk and passes through the great sacro-sciatic foramen below the Pyriformis, then descends between the tuberosity of the ischium and the trochanter of the femur under the Gluteus maximus, and then helps to form the **crucial anastomosis** which is made by four branches, the first three of which are branches of the profunda artery and the fourth is THE SCIATIC BRANCH. The first three branches are named INTERNAL CIRCUMFLEX, EXTERNAL CIRCUMFLEX, and SUPERIOR PERFORATING. Inside the pelvis the sciatic artery gives branches to the rectum, neck and base of bladder, prostate gland, and muscles of the floor of the pelvis. Outside the pelvis the sciatic artery gives anastomotic and coccygeal branches, which run through the great sacro-sciatic ligament to the back of the coccyx, and inferior gluteal branches (which are three or four) to the Gluteus maximus, and muscular branches to the muscles on the back of the hip. It sends articular branches to the hip-joint and COMES NERVI ISCHIADICI to the great sciatic nerve. The **uterine branch** runs to the cervix of the uterus and then along its sides in the broad ligament to anastomose with the ovarian. This artery is above and in front of the ureter.

The Relations of the Common Iliac Arteries. (Plates LXXII-XCI.) The right common iliac artery has the following relations:

IN FRONT.—(1) Peritoneum, (2) Small intestine, (3) Sympathetic nerves, and (4) Ureter.

BEHIND.—(1) Fourth and fifth lumbar vertebræ, (2) Right common iliac vein, (3) Left common iliac vein.

OUTER SIDE.—(1) Vena cava, (2) Right common iliac vein, (3) Psoas muscle.

INNER SIDE.—(1) Left common iliac vein.

The Left Common Iliac Artery has the following relations:

IN FRONT.—(1) Peritoneum, (2) Small intestine, (3) Sympathetic nerves, (4) Superior hemorrhoidal artery, (5) Ureter.

BEHIND.—(1) Fourth and fifth lumbar vertebræ, (2) Left common iliac vein.

OUTER SIDE.—Psoas magnus muscle.

INNER SIDE.—Left common iliac vein.

The Relations of the Internal Iliac Artery.—(Plates LXXII-XCI.)

IN FRONT.—(1) Peritoneum, and (2) Ureter.

BEHIND.—(1) Internal iliac vein, (2) Lumbo-sacral cord, (3) Pyriformis muscle.

OUTER SIDE.—Psoas magnus.

The Relations of the External Iliac Artery. (Plate XCI.)

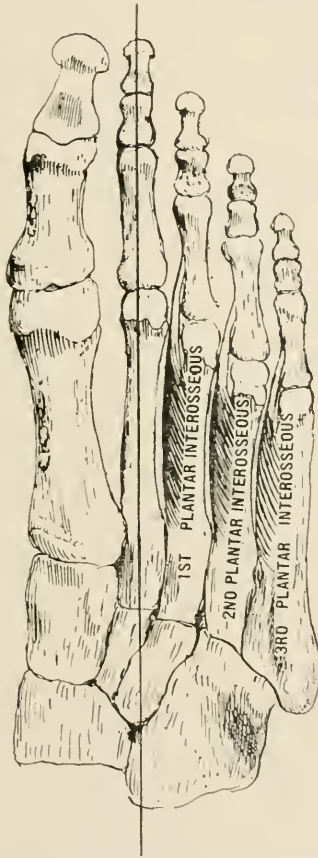
IN FRONT.—(1) Peritoneum, (2) Intestines, (3) Fascia. (4) Lymphatic vessels, (5) Lymphatic glands, (6) Spermatic vessels, (7) Genito-crural nerve (genital branch.) (8) Deep circumflex iliac vein.

BEHIND.—(1) External iliac vein, (2) Psoas magnus.

OUTER SIDE.—(1) Psoas magnus, (2) Iliac fascia.

INNER SIDE.—(1) External iliac vein, (2) vas deferens near Poupart's ligament.

PLATE LXII.



THE THREE PLANTAR INTEROSSEL.

LESSON XLVII.

The **external iliac artery** passes from its origin, which is at the lumbo-sacral articulation, along the inner border of the Psoas magnus muscle to pass under Poupart's ligament after which it is called the common femoral artery. It gives branches to the Psoas magnus and the lymphatic nodes. The **deep epigastric** is a branch of this artery and after descending to Poupart's ligament it

lies between the peritoneum and the transversalis fascia. After passing under the vas deferens in the male or the round ligament in the female it curves around the lower and inner margin of the internal abdominal ring, then ascending it pierces the transversalis fascia and the sheath of the Rectus muscle to enter into the longest arterial anastomosis in the body by anastomosing with the superior epigastric branch of internal mammary artery. It gives the **CREMASTERIC BRANCH** to the Cremasteric muscle on spermatic cord, **PUBIC BRANCH** to the back of the pubes, and **MUSCULAR BRANCHES** to the adjacent muscles and integument.

The **deep circumflex iliac artery** is also a branch of the external iliac and after passing along Poupart's ligament to the anterior superior spine it continues to the crest of the ilium. The **femoral artery** is a continuation of the external iliac and passes through the middle of Scarpa's triangle just internal to the head of the femur. This artery is an inch or two in length and here it gives off the **profunda artery** and continues as the **superficial femoral**. The superficial femoral passes to the apex of Scarpa's triangle then through Hunter's canal, and after passing through an opening in the Adductor magnus, at the junction of the middle and lower third of the thigh close to the bone, it is called the **popliteal artery**.

Scarpa's triangle.—(Plate LXXIV.) is bounded above by **POUPART'S LIGAMENT**, externally by the **SARTORIUS MUSCLE**, and internally by the **ADDUCTOR LONGUS**. Its floor is formed from without inward by the **ILIACUS**, **PSOAS**, **PECTINEUS**, **ADDUCTOR BREVIS** (?) and **ADDUCTOR LONGUS**. The femoral vein lies on the inner side of the femoral artery and the anterior crural nerve lies on its outer side. Lymphatics and fat are behind the nerve.

Hunter's canal.—(Plates LXIV-LXXVIII.) occupies the middle third of the thigh, while Scarpa's triangle occupies the upper third. This canal is bounded externally by the **VASTUS INTERNUS** and antero-internally by **AN APONEUROSIS** passing from the Vastus internus to the Adductor longus and magnus which form its posterior boundary. This aponeurosis has above it the Sartorius. The femoral vessels and long saphenous nerve pass through this canal. The nerve is external to and the vein postero-external to the artery.

The Relations of the Common Femoral Artery. (Plates LXXII-LXIV-LXVIII.)

IN FRONT.—(1) Skin, (2) Superficial fascia, (3) Superficial inguinal glands, (4) Iliac portion of fascia lata, (5) Prolongation of transversalis fascia, (6) Crural branch of genito-crural nerve, (7) Superficial circumflex iliac vein, (8) Superficial epigastric vein.

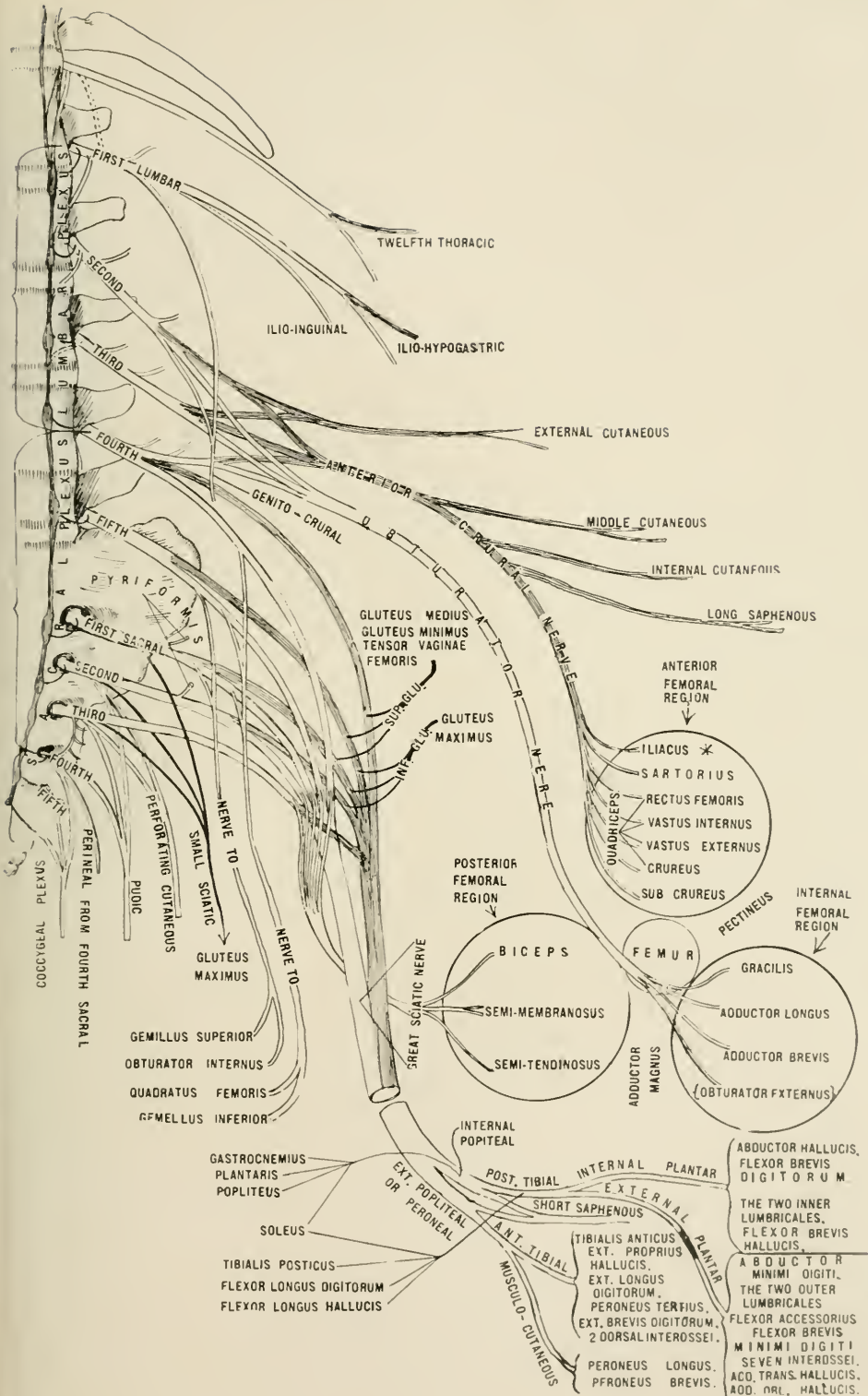
BEHIND.—(1) Prolongation of fascia covering Iliacus muscle, (2) Pubic portion of fascia lata, (3) Nerve to Pectineus, (4) Psoas muscle, (5) Pectineus muscle, (6) Capsule of hip-joint.

OUTER SIDE.—(1) Anterior crural nerve, (2) Small part of Psoas muscle.

INNER SIDE.—Femoral vein.

The Relations of the Superficial Femoral Artery. (Plates LXXII-LXIV.)

IN FRONT.—(1) Skin, (2) Superficial and deep fasciæ, (3) Internal cutane-



LUMBAR, SACRAL AND COCCYGEAL PLEXUSES.

ous nerve, (4) Sartorius muscle, (5) Aponeurostic covering of Hunter's canal, (6) Internal saphenous nerve.

BEHIND.—(1) Femoral vein, (2) Profunda artery, (3) Profunda vein, (4) Pectineus muscle, (5) Adductor longus, (6) Adductor magnus.

OUTER SIDE.—(1) Long saphenous nerve, (2) Nerve to Vastus internus, (3) Vastus internus, (4) Femoral vein (below.)

INNER SIDE.—(1) Adductor longus, (2) Adductor magnus, (3) Sartorius.

The Relations of the Profunda Artery. (Plates LXXII-LXIV.)

IN FRONT.—(1) Femoral vein, (2) Profunda vein, (3) Superficial femoral artery, (4) Adductor longus muscle.

BEHIND.—(1) Iliacus, (2) Pectineus, (3) Adductor brevis, (4) Adductor magnus.

OUTER SIDE.—Vastus internus.

INNER SIDE.—Pectineus.

The Relations of the Popliteal Artery. (Plates LXXII-LXIX-LXX.)

IN FRONT.—(1) Femur, (2) Ligamentum posticum, (3) Popliteus.

BEHIND.—(1) Semimembranosus, (2) Fascia, (3) Popliteal vein, (4) Internal popliteal artery, (5) Gastrocnemius, (6) Plantaris, (7) Soleus.

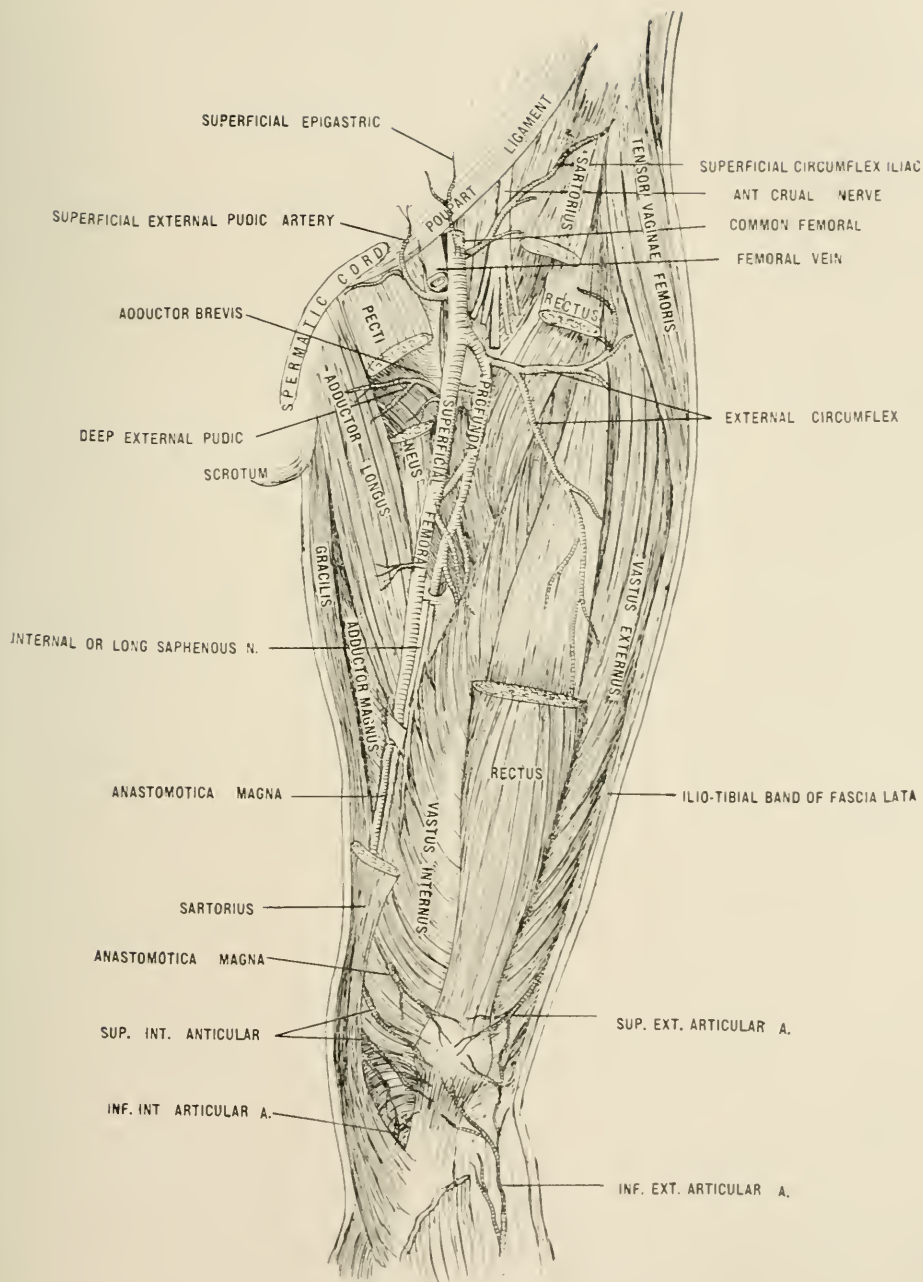
OUTER SIDE.—(1) Biceps, (2) Outer condyle, (3) Gastrocnemius (outer head,) (4) Plantaris, (5) Internal popliteal nerve (above.)

INNER SIDE.—(1) Semimembranosus, (2) Internal condyle, (3) Gastrocnemius (inner head.)

LESSON XLVIII.

The **branches of the common femoral artery** are, (1) superficial epigastric, (2) superficial circumflex iliac, (3) superficial external pudic, (4) deep external pudic. The **branches of the superficial femoral** are, (1) muscular branches, (2) anastomotica magna. The **branches of the profunda femoral** are, (1) internal circumflex, (2) external circumflex, (3) perforating.

The **superficial epigastric artery** passes through the saphenous opening and ascends almost to the umbilicus, lying in the superficial fascia on the external oblique muscle. It anastomoses with branches of the deep epigastric artery. The **superficial circumflex iliac artery**, after piercing the fascia lata, runs to the anterior superior spine and crest of the ilium below Poupart's ligament. It anastomoses with the deep circumflex iliac and with the gluteal and external circumflex arteries. The **superficial external pudic artery**, also called **superior**, passes through the saphenous opening across the spermatic cord in the male and round ligament in the female to the lower part of the abdominal wall, penis, scrotum in the male, and the labium in the female. It anastomoses with branches of the internal pudic. The **deep external pudic artery**, also called **inferior**, crosses the Pectineus muscle then pierces the fascia lata to pass to the skin of perineum and scrotum in the male or labium in the female. It anastomoses with branches of superficial perineal artery. The **muscular branches** of the superficial femoral artery vary in number from two to seven and go mainly to the Sartorius and Vastus internus muscles. The **anastomotica magna** which

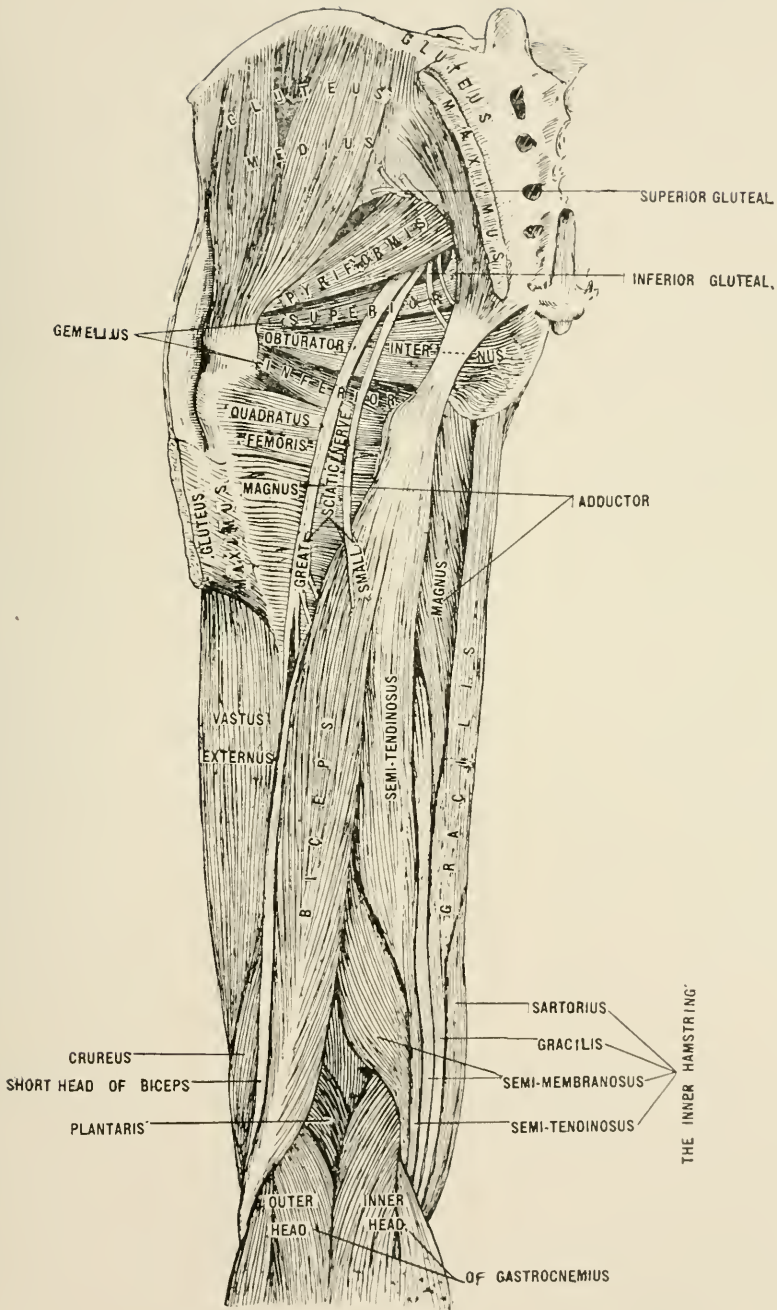


COMMON, SUPERFICIAL AND PROFUNDA FEMORAL ARTERIES.

arises near the end of the femoral divides into a superficial branch which passes with the long saphenous nerve, and a deep branch which runs in front of the tendon of the Adductor magnus to the inner side of the knee-joint, where it anastomoses with the anterior tibial recurrent and the superior internal articular arteries. The **profunda artery itself** passes behind the superficial femoral vessels on the inner side of the femur and then behind the Adductor longus to pierce the Adductor magnus at the lower third of the thigh. This is sometimes called the fourth perforating branch. The internal circumflex of the profunda passes between the Psoas magnus and the Pectineus to the upper border of the Adductor brevis, at this point it sends one branch inward to the Adductor muscles and another branch downward under the Adductor brevis. The **internal circumflex artery itself** now passes between the Quadratus femoris and the Adductor magnus to join the crucial anastomosis which is formed by THE INTERNAL CIRCUMFLEX ARTERY, THE EXTERNAL CIRCUMFLEX ARTERY and THE SUPERIOR PERFORATING all of which are branches of the profunda, and THE SCIATIC ARTERY which is one of the terminal branches of the anterior trunk of the internal iliac. The **external circumflex** of the profunda passes outward under the Sartorius and Rectus muscles where it divides into ascending branches, descending branches, transverse branches. The ASCENDING BRANCHES run upward under the Tensor vagina femoris. The DESCENDING BRANCHES run under the Rectus as far as the knee to enter into the circumpatellar anastomosis. The TRANSVERSE BRANCHES pass outward over the Crureus muscle and through the Vastus externus to the back of the thigh to enter into the crucial anastomosis. This **external circumflex artery** passes between the anterior and posterior divisions of the anterior crural nerve. The **three perforating branches** of the profunda pierce the tendon of the Adductor magnus to reach the back of the thigh. The SUPERIOR ONE passes above the Adductor brevis to join the crucial anastomosis. The MIDDLE ONE pierces the Adductor brevis. The INFERIOR ONE passes below the Adductor brevis.

The **popliteal artery** is a continuation of the femoral and passes through the popliteal space downward and outward. At the lower border of the Popliteus muscle it gives off the **anterior tibial artery** and continues as the **posterior tibial artery**.

The **popliteal space** lies behind the knee-joint and is diamond shaped. This space has a FLOOR, a ROOF, and LATERAL BOUNDARIES. It is bounded above the knee-joint externally by the Biceps, and below the joint by the Plantaris and the outer head of the Gastrocnemius. It is bounded above the joint internally by the Semimembranosus and below the joint by the inner head of the Gastrocnemius. Its floor is formed by bones, ligament and muscle. The bones are the femur and tibia, the ligament is the posterior ligament of the knee-joint, and the muscle is the Popliteus. The **popliteal artery** passes obliquely across the space being surrounded by popliteal nodes, and has the articular branch of the obturator nerve lying upon it. The **popliteal veins** are superficial and external to the artery. An articular filament of the great sciatic nerve is often found deep in this space. The **internal popliteal** or **popliteal nerve** crosses all



MUSCLES IN THE GLUTEAL REGION AND BACK OF THIGH.

these structures superficially in the median line, and the **external popliteal** or **peroneal nerve** lies close to the tendon of the Biceps.

The **branches of the popliteal artery** are, (1) **cutaneous branches**, three in number which descend in the median line and on each side run across the Gastrocnemius to the calf of the leg. These branches may arise from other branches. (2) **Superior muscular branches**, two or three in number pass to the Vastus externus and flexors of the thigh. (3) **Inferior muscular or sural branches** generally two branches pass to the Gastrocnemius and Plantaris muscles. (4) **Superior internal articular branch** which passes under the tendon of the Adductor magnus muscle divides, one of the branches joining the superior external articular artery and the other branch joining the anastomotica magna and the inferior internal articular artery. (5) **Superior external articular artery** which passes above the outer condyle under the tendon of the Biceps divides into a deep branch which joins the inferior internal articular artery, and anastomotica magna artery and a superficial branch which joins the inferior external articular and the descending branch of the external circumflex artery. (6) The **azygos articular** pierces the posterior ligament of the knee-joint to supply that joint. (7) **Inferior internal articular** passes below the inner tuberosity of the tibia under the internal lateral ligament to join the inferior external and superior internal articular arteries. (8) **Inferior external articular artery** passes above the fibula under the tendon of the Biceps and external lateral ligament to join the anterior tibial recurrent and the inferior internal articular and the superior external articular arteries.

The **circumapatellar anastomosis** (Plates LXXII-LXXVI) is formed by the (1) superior external articular, (2) superior internal articular, (3) inferior external articular, (4) inferior internal articular, (5) fourth perforating or terminal branch of the profunda, (6) anastomotica magna, (7) descending branch of the external circumflex, and (8) the anterior tibial recurrent. This anastomosis has superficial and deep portions. If we substitute in this anastomosis the fourth perforating or terminal branch of the profunda for the posterior tibial recurrent and azygos articular, we will have the blood supply to the knee-joint.

LESSON XLIX.

The **anterior tibial artery** (Plates LXXII-LXXVI) runs forward between the two heads of the Tibialis posticus above the interosseous membrane. It now descends on the anterior surface of this membrane and crosses the anterior surface of the tibia distally and the anterior ligament of the ankle-joint. Below this joint it is called dorsalis pedis artery. The branches of the anterior tibial artery are, (1) **muscular**, which go to the muscles of the leg. (2) **Posterior tibial recurrent branch** (which is not always present) passes under the Popliteus muscle. (3) **Superior tibular branch** which passes around the neck of the fibula and through the Soleus muscle to the Peroneus longus. (4) **Anterior tibial recurrent** which passes upward through the Tibialis anticus to go to the circumapatellar anastomosis. (5) **Internal malleolar branch** passes under the tendons

of the Extensor proprius hallucis and Tibialis anticus to the inner malleolus. (6) The **external malleolar** passes under the tendons of the Extensor longus digitorum and Peroneus tertius to the outer malleolus.

The Relations of the Anterior Tibial Artery.

IN FRONT.—(1) Integument, (2) Superficial and deep fascia, (3) Anterior tibial nerve, (4) Tibialis anticus (overlaps it in the upper part of the leg), (5) Extensor longus digitorum (overlaps it slightly), (6) Extensor proprius hallucis (overlaps it slightly), (7) Anterior annular ligament.

BEHIND.—(1) Interosseous membrane, (2) Tibia, (3) Anterior ligament of ankle-joint.

OUTER SIDE.—(1) Anterior tibial nerve, (2) Extensor longus digitorum, (3) Extensor proprius hallucis.

INNER SIDE.—(1) Tibialis anticus, (2) Extensor proprius hallucis (crosses it at its lower part).

The **dorsalis pedis artery** (Plates LXXII-LXXVI.) is the continuation of the anterior tibial. It passes along the inner side of the foot from the ankle-joint to the first intermetatarsal space, where it divides into **dorsalis hallucis** artery and the **communicating artery**. The dorsalis hallucis artery, also called first dorsal interosseous, passes in the first interosseous space to the base of the great toe where it divides into two branches which pass to the dorsal aspect of the adjacent sides of the great and second toes. Prior to this division it gives off a **branch** which passes under the Extensor proprius hallucis tendon and runs along the dorsal aspect of the inner side of the great toe. The communicating branch, also called the **plantar digital**, passes between the two heads of the First dorsal interosseous muscle to join the external plantar artery, thus completing the plantar arch. It now gives off the *arteria princeps hallucis* which runs along the plantar surface of the first interosseous space and divides at the base of the toes into two branches for the plantar aspect of the sides of the great toe. Besides these terminal branches it gives off (1) **external tarsal**, (2) **internal tarsal**. These branches run outward and inward across the cuboid and scaphoid bones. (3) **Metatarsal** which passes across the base of the metatarsal bones externally. This artery gives off **THREE INTEROSSEOUS ARTERIES** which pass in the three outer interosseous spaces to the base of the toes where they divide into internal and external branches for the dorsal aspect of adjacent sides of the four outer toes. The outer interosseous branch before its division at the base of the toes sends a branch along the dorsal aspect of the outer side of the little toe. These three arteries each receives a posterior perforating branch from the plantar arch at the base of the space, also an anterior perforating branch from the digital artery at the front of the space.

The Relations of the Dorsalis Pedis Artery.

IN FRONT.—(1) Integument, (2) Fascia, (3) Anterior annular ligament, (4) Innermost tendon of Extensor brevis digitorum.

BEHIND.—(1) Astragalus, (2) Navicular, (3) Middle cuneiform, (4) The ligaments to these bones.

OUTER SIDE.—(1) Extensor longus digitorum, (2) Anterior tibial nerve.

INNER SIDE.—Extensor proprius hallucis.

LESSON L.

The **posterior tibial artery** (Plates LXIX-LXX) is a continuation of the popliteal artery and commences at the lower border of the Popliteus muscle, from here it passes to the interval between the heel and the internal malleolus

PLATE LXVII.



EXTERNAL OR SHORT SAPHENOUS VEIN.

where it divides into the internal and external plantar arteries. Along its course it lies upon the Tibialis posticus, Flexor longus digitorum, tibia, and ankle-joint. The branches of the posterior tibial artery are, (1) The **peroneal**

artery which arises about an inch below the Popliteus and passes along the inner side of the fibula to the lower third of the leg where it divides into an anterior and posterior peroneal. The peroneal artery itself gives off (a) **MUSCULAR BRANCHES** to the muscles at the back and outer side of the leg, (b) **NUTRIENT** to fibula, (c) **ANTERIOR PERONEAL** which runs through the interosseous membrane and then descends to the outer ankle, (d) **COMMUNICATING** branch runs inward to unite with a similar branch of the posterior tibial. (e) **POSTERIOR PERONEAL** continues with the main artery to the outer side of the os calcis. (f) The **EXTERNAL CALCANEAN** sends several branches to the outer side of the heel. (2) Muscular branches which pass to the muscles on the back of the leg. (3) Nutrient to the tibia. This branch also gives off muscular branches. (4) Communicating branch which runs across the tibia and unites with a similar branch from the peroneal. (5) Internal calcanean which sends several branches to the internal side of the heel.

The **external plantar artery** (Plates LV-LVI-LVIII) passes between the Flexor brevis digitorum and Flexor accessorius to the base of the fifth metatarsal bone. It now bends inward and arches across the bases of the fourth, third, and second metatarsals to the interval between the second and first metatarsal, where it joins the communicating branch of the dorsalis pedis to complete the plantar arch. The branches of the external plantar are (1) **posterior perforating** which are three in number and run between the heads of the three outer Dorsal interossei to join the interosseous branches of the metatarsal arteries. (2) **Digital branches** are four. The first runs along the outer side and plantar aspect of the little toe, the outer branches run along the three outer interosseous spaces to the base of the toes where each one sends an anterior perforating branch to join an interosseous branch of the metatarsal, and then divides into two branches for the adjacent sides and plantar aspects of the toes.

The **internal plantar artery** (Plates LV-LVI-LVIII) passes above the Abductor hallucis, then between it and the Flexor brevis digitorum, and from here along the inner side of the great toe to anastomose with the digital branch from the princeps hallucis.

The Relations of the Posterior Tibial Artery.

IN FRONT.—(1) Tibialis posticus, (2) Flexor longus digitorum, (3) Tibia, (4) Ankle-joint.

BEHIND.—(1) Integument, (2) Fascia, (3) Gastrocnemius, (4) Soleus, (5) Deep transverse fascia, (6) Posterior tibial nerve, (7) Abductor hallucis.

OUTER SIDE.—Posterior tibial nerve, lower two-thirds.

INNER SIDE.—Posterior tibial nerve, upper third.

The Relations of the Peroneal Artery. (Plate LXIX.)

IN FRONT.—(1) Tibialis posticus, (2) Flexor longus hallucis.

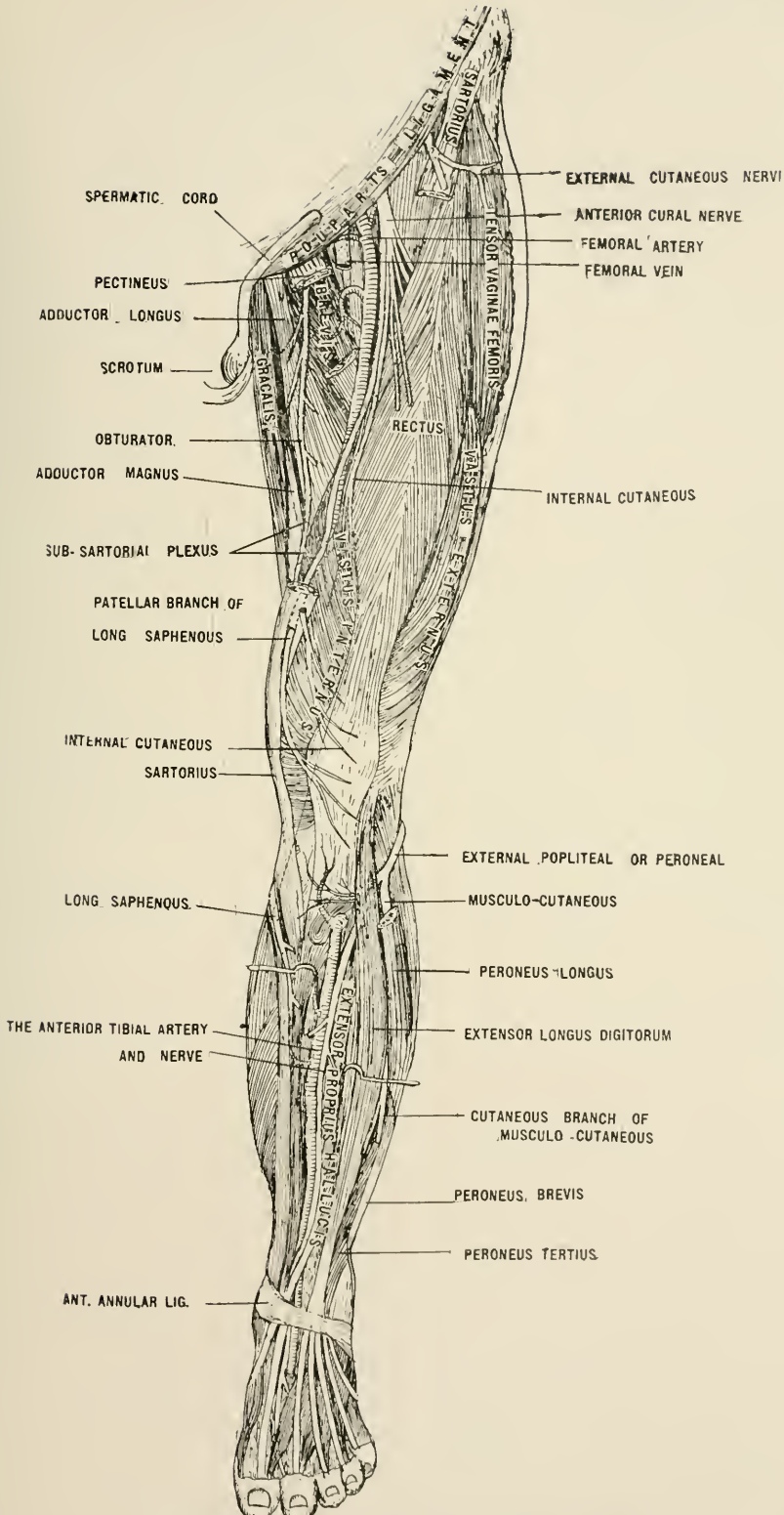
BEHIND.—(1) Soleus, (2) Deep transverse fascia, (3) Flexor longus hallucis

OUTER SIDE.—(1) Fibula, (2) Flexor longus hallucis.

INNER SIDE.—Flexor longus hallucis.

VEINS.

The **external iliac vein** (Plate XC) is a continuation of the femoral vein



ANTERIOR VIEW OF ENTIRE LOWER LIMB.

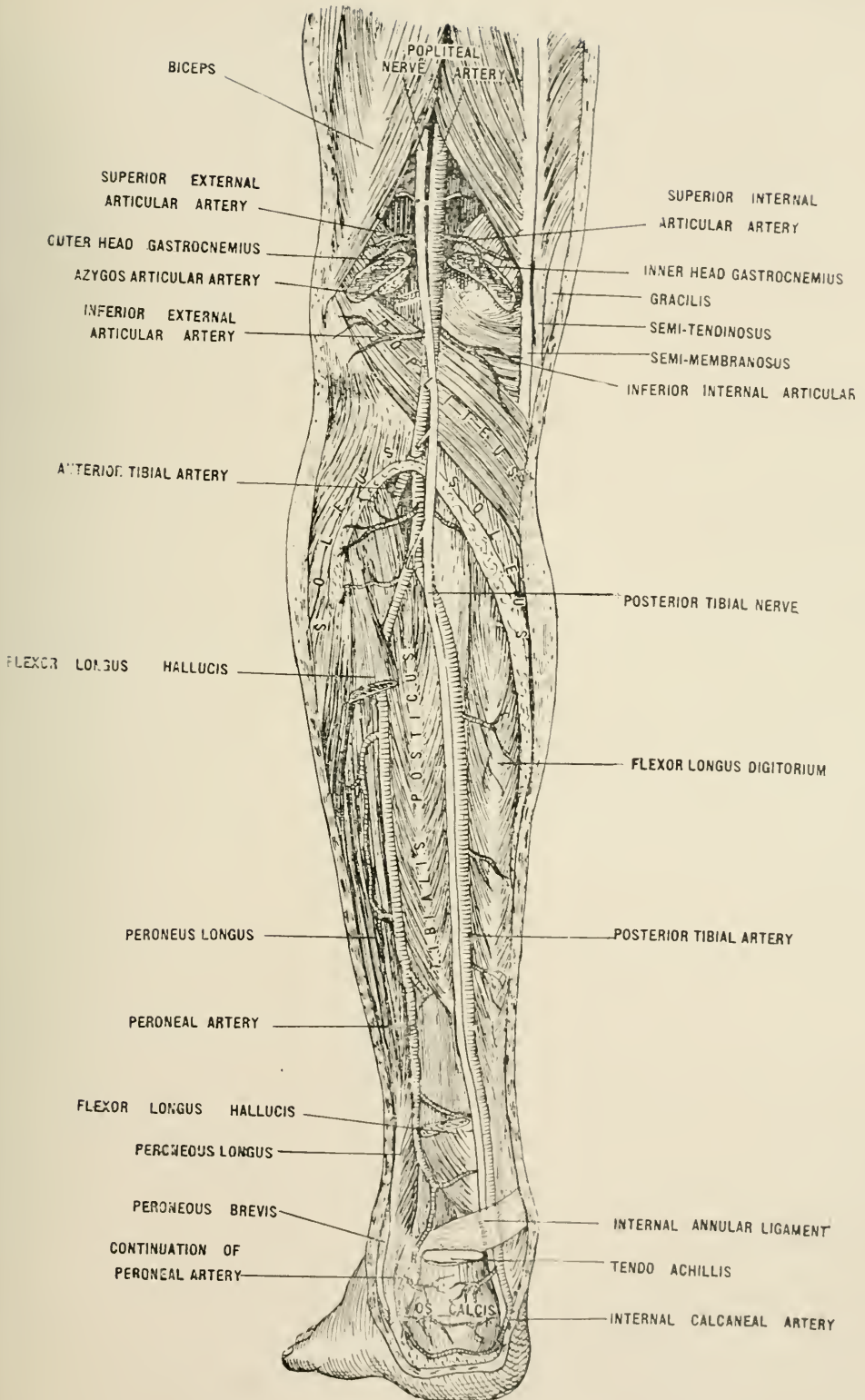
above Poupart's ligament to the sacro-iliac articulation, where it joins the internal iliac vein to make the common iliac vein. The **right common iliac vein** is on the outer side of the right common iliac artery, but as it passes upward it goes behind the artery. The **left common iliac vein** is on the inner side of the left common iliac artery throughout its course. The radicles of the external iliac vein are the deep epigastric and the deep circumflex iliac veins, and a small pubic vein. The external iliac vein may have one or two valves.

The **internal iliac vein**, which unites with the external iliac vein at the sacro-iliac articulation to form the common iliac vein, lies at first on the inner side of and then behind the artery. It receives radicles corresponding to all the branches of the internal iliac artery except the umbilical (hypogastric.) It drains the viscera in the pelvis in the following manner: (1) the **internal pudic vein** receives radicles which corresponds to all the branches of the internal pudic artery except the dorsal artery of the penis. (2) Around the lower end of the rectum there is a **hemorrhoidal plexus** which is formed by the hemorrhoidal veins. (3) The blood which passes through the **superior hemorrhoidal vein** empties into the inferior mesenteric vein, while the blood which empties into the **middle** and **inferior veins** passes into the internal iliac vein, thus is established a free communication between the portal venous system and the general venous system. (4) The **plexus**, which surrounds the vaginal mucous membrane and is well developed near the orifice, and anastomoses with the vesical and hemorrhoidal plexuses before it joins the internal iliac vein. (5) The plexus which lies at the sides and upper angles of the uterus between the layers of the broad ligament is called **uterine plexus**, and it drains the substance of the uterus and communicates with the ovarian veins before it joins the internal iliac vein.

The **common iliac veins** are formed by the external and internal iliac veins at the sacro-iliac articulation from which point they ascend obliquely upward to the right side of the median line of the spine between the fourth and fifth lumbar vertebra where they join one another to form the inferior vena cava. The **right one**, which is more vertical than the left, passes at first behind and then to the outer side of the common iliac artery. The **left one**, which is more oblique and longer than the right, passes, for the most part, to the right side of the left common iliac artery but passes behind its artery above. Each of these veins receives the ilio-lumbar vein and occasionally the lateral sacral vein. The left one, in addition, receives the middle sacral vein. No valves are found in these veins.

The **inferior vena cava**, (Plate XC) which ends in the lower and back part of the right auricle of the heart near the Eustachian valve, has no length above the Diaphragm. It passes from the fifth lumbar vertebra where it is formed by the right and left common iliac veins upward in front of the spine on the right side of the aorta, and in its course it passes in a groove on the posterior surface of the liver and pierces the central tendon of the Diaphragm. At this point it enters the fibrous pericardium and is partially invested by the serous pericardium.

The **lumbar veins**, (Plate XC) which drain the structures of the abdominal



SHOWING ARTERIES AND NERVES OF BACK OF LEG.

walls and the loins, are four on each side, and they are all connected by longitudinal ascending lumbar veins. This ascending vein passes in front of the transverse processes in the lumbar region and gives origin to the azygos vein of its own side. The **left lumbar veins** pass behind the aorta. The **pampiniform plexus** lies around the spermatic cord in front of the vas deferens and is formed by the spermatic veins which drain the testis and epididymis. This plexus forms three or four main trunks which pass through the inguinal canal to form two veins. These veins accompany the spermatic artery and finally make one trunk. The **SPERMATIC VEINS ON THE RIGHT** side empties into the inferior vena cava, while **THE ONE ON THE LEFT** side passes behind the sigmoid flexure to enter the left renal vein. The one on the right side has a valve.

The **plexus in the broad ligament** near the ovary and around the fallopian tube is formed by the ovarian veins and communicates with the uterine plexus. These ovarian veins are similar to the spermatic veins, that is the one on the right side empties into the inferior vena cava, while the one on the left side empties into the left renal vein.

The **renal veins** lie in front of their companion arteries which is an exception for the veins below the Diaphragm. The left vein passes in front of the aorta where it empties into the inferior vena cava at a higher level than the right, and is the longer of the two renal veins. Its radicles are the left spermatic or ovarian, left inferior phrenic, and most always the left suprarenal.

The **left suprarenal vein** empties into the left renal or phrenic while the right empties into the inferior vena cava.

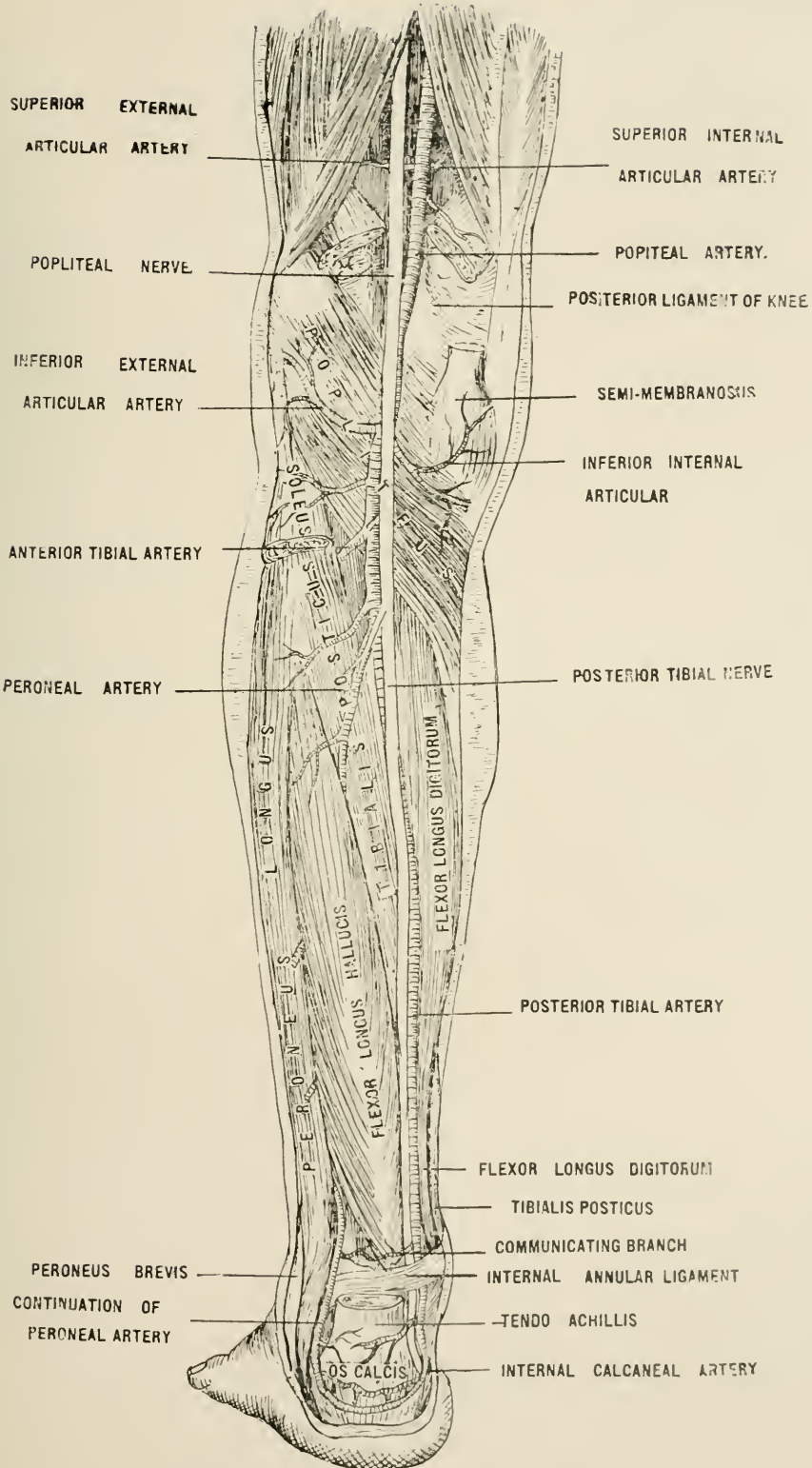
The **two superior phrenic veins** end in the internal mammary vein, after accompanying the phrenic nerve and comes nervi phrenici artery. The two inferior phrenic veins accompany the phrenic arteries and join the inferior vena cava on the right side and the left renal vein on the left side.

LESSON LI.

The **hepatic veins** begin in the liver in the capillaries of the intralobular veins and form three main veins which empty into the inferior vena cava as it lies in the groove on the posterior surface of the liver. There are no valves in these veins. The blood which passes through the portal vein goes through the following vessels: those on the left; before it reaches the inferior vena cava: while those on the right represent the vessels used by the Hepatic artery.

- | | |
|----------------------------------|---|
| 1. Portal vein | 1. Hepatic artery |
| 2. Interlobular vein | 2. Interlobular artery |
| 3. Intralobular capillary plexus | 3. Its own intralobular capillaries |
| 4. Intralobular vein | 4. Portal intralobular capillary plexus |
| 5. Sublobular vein | 5. Intralobular vein |
| 6. Hepatic vein | 6. Sublobular vein |
| 7. Inferior vena cava | 7. Hepatic vein |
| | 8. Inferior vena cava. |

It will be noticed that the blood which passes through the Portal vein and the Hepatic artery has a similar route through the last five vessels.



SHOWING MUSCLES OF BACK OF LEG.

The **veins of the lower extremity** are divided into a superficial and deep set like those of the upper extremity, but the valves are more numerous. The superficial veins of the lower extremity lie between the two layers of the superficial fascia. The veins on the dorsum of the foot form a venous arch, which has its concavity backward. This arch receives digital radicles from the dorsum of the toes, and it crosses the anterior extremities of the metatarsal bones. This arch ends externally in the short saphenous vein and internally in the long saphenous.

The **external or short saphenous vein** (Plate LXVII) is a continuation of this arch and ascends behind the outer malleolus along the outer border of the tendo Achillis, from here it crosses to the inner border in the median line of the leg posteriorly to perforate the deep fascia in the lower part of the popliteal space where it ends in the popliteal vein between the two heads of the Gastrocnemius. It receives cutaneous radicles in its course and it sends a communicating branch from near its end upward and inward to the long saphenous vein. It communicates with the deep veins below and accompanies the external saphenous nerve. This vein has from nine to fourteen valves in it.

The **internal or long saphenous vein** (Plate LXVI) is a continuation of the arch and ascends in front of the internal malleolus along the inner side of the leg. From this point it accompanies the internal saphenous nerve behind the inner margin of the tibia and at the knee it runs backward behind the inner condyle of the femur. From here it passes along the inner side of the thigh to pass through the saphenous opening where it ends in the femoral vein about an inch and a half below Poupart's ligament. It communicates with the deep veins and receives cutaneous radicles in its course. It receives the superficial epigastric, superficial circumflex iliac, and external pudic veins at the saphenous opening. This vein may be double and it has from seven to twenty valves in it.

The **deep veins of the lower extremity** accompany their arteries and are called *venæ comites* and have numerous valves. *Venæ comites* are not found from the knee to the hip, for in this region there is but one vein for the artery.

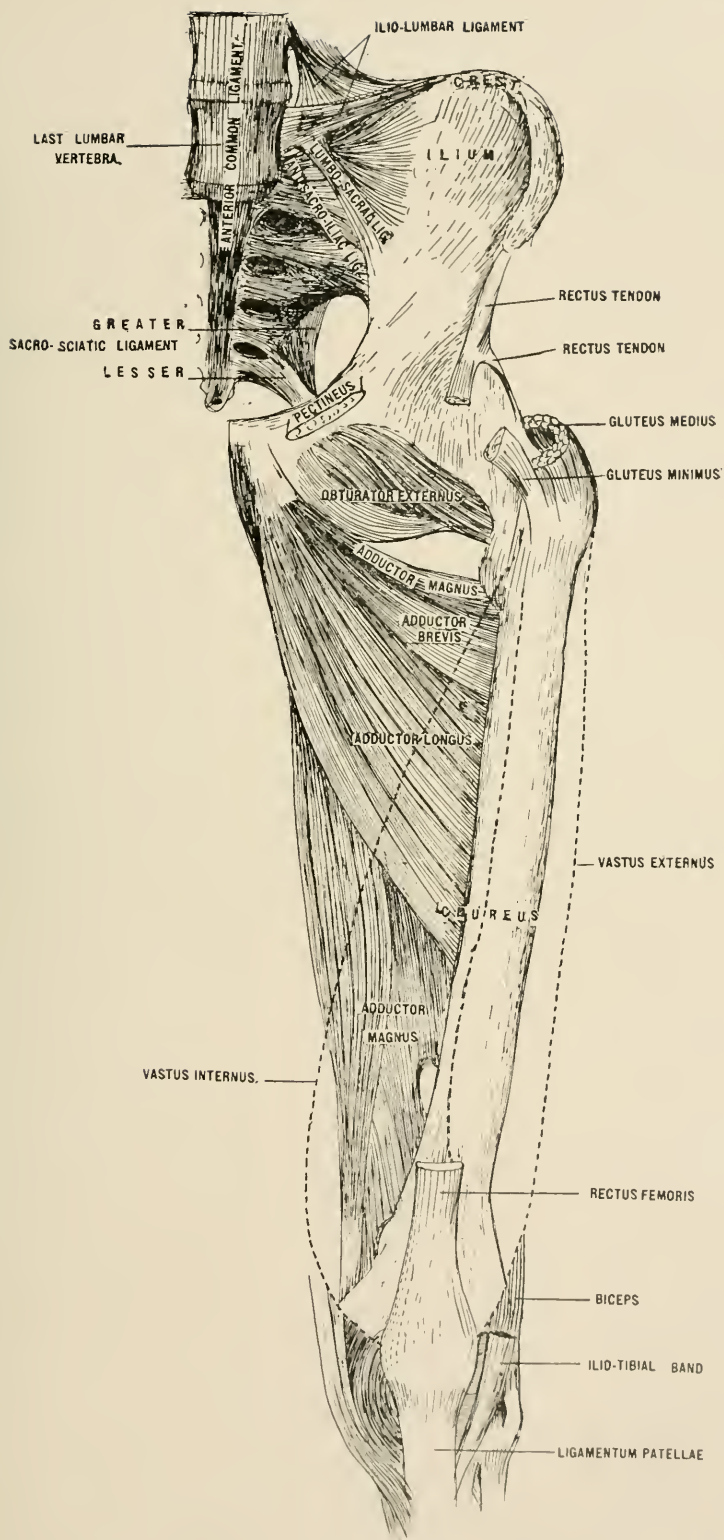
The **posterior tibial veins** are formed by the internal and external plantar, and are joined by the peroneal veins.

The **anterior tibial veins** accompany the anterior tibial artery and join the posterior tibial veins to form the popliteal vein.

The **popliteal vein** passes through the popliteal space, passing from the lower to the upper boundary obliquely outward and becomes the femoral vein at the aperture in the Adductor magnus muscle. This vein receives the external saphenous vein, articular and sural veins.

The **femoral vein** accompanies the femoral artery and passes under the artery from its outer to its inner side. This vein continues as the external iliac after it passes under Poupart's ligament. It has four or five valves and receives radicles corresponding to the arterial branches and the internal saphenous vein.

Talipes comes from two words, *talus* which means ankle, and *pes* which means foot. This deformity, called club-foot, depends upon the contraction of muscles or tendons, and this contraction may either be congenital or acquired.



SHOWING MUSCLES OF INNER AND ANTERIOR PART OF THE THIGH.

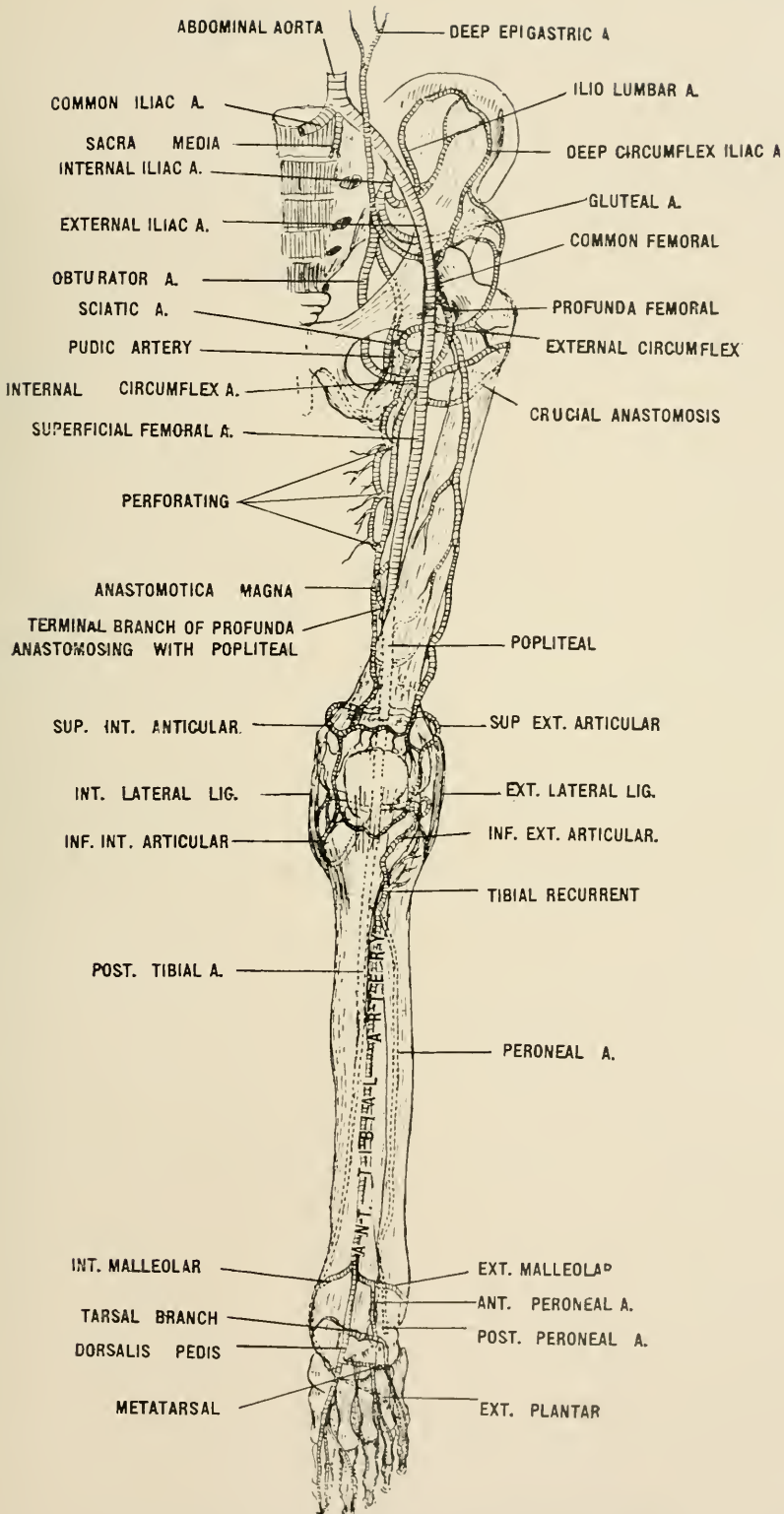
We have the following forms of club-foot: (1) **Talipes equinus** in which the heel is elevated and the weight of the body thrown upon the anterior portion of the foot. (2) **Talipes calcaneus** in which the patient walks upon the heel. (3) **Talipes cavus** or **arcuatus** in which there is an increased curvature in the arch of the foot. (4) **Talipes varus** in which the foot is turned inward the patient walking on the outer border. (5) **Talipes valgus** (flat or splay foot) in which the foot is everted or distorted outward. Combinations of these may occur, such as **Talipes equino-varus**, **Talipes calcaneo-varus**, **Talipes calcaneo-valgus**, **Talipes equino-valgus**. (Plate LXXXIX.)

The following are some of the principal amputations of the whole or part of the foot. (1) **Syme's amputation** is made at the ankle-joint, leaving a large heel flap and removing the internal malleolus and the external malleolus and sometimes a slice from the lower part of the tibia. (2) **Roux's amputation** is made at the ankle-joint, leaving a large internal flap. (3) **Pirogoff's amputation** is made by removing all the tarsal bones, except the posterior part of the os calcis, and a thin slice from the tibia and fibula including the two malleoli. The small portion of the os calcis which remains is then turned up and united to the lower surface of the tibia. (4) **Sub-astragaloid amputation** is made by removing all the bones of the foot except the astragalus. This operation is rarely performed. (5) **Chopart's amputation** is made by removing all the bones of the foot except the os calcis and astragalus. (6) **Lisfranc's amputation** is made by removing all the metatarsals and phalanges, but not cutting any of the bones. (7) **Hey's amputation** is a modification of Lisfranc's amputation by sawing through the internal cuneiform bone. (8) **Skey's amputation** is a modification of Lisfranc's amputation by sawing off the base of the second metatarsal bone. A combination of Pirogoff's and the sub-astragaloid is **Hancock's amputation**.

LESSON LII.

HIP-JOINT. (Plate LXXXII.)

This **joint** is a diarthrodial joint and belongs to the subclass enarthrodial. It has five ligaments. (1) The **capsular ligament**, which is very strong and fibrous, surrounds the brim of the acetabulum, being just external to the cotyloid ligament. Below it is attached to the neck of the femur into the anterior intertrochanteric line anteriorly, to the root of the neck of the femur superiorly, and to the middle of the neck of the femur posteriorly. It has two sets of fibers, circular and longitudinal. The circular are best developed at the lower and posterior part where they form a collar called the *zona orbicularis* or ligament of Bertin. The longitudinal fibers form the accessory ligaments. Sometimes there is an opening in the front of the capsular ligament for the passage of synovial membrane to form a bursa under the Psoas magnus. (2) The **ilio-femoral** or **Y ligament** is accessory to the capsular ligament, it is bifurcated below and is connected to the anterior intertrochanteric line at its outer and inner portions and it is attached above to the anterior inferior spine of the ilium. (a) THE **ISCHIO-CAPSULAR LIGAMENT** is an accessory ligament being attached to the ischium below the acetabulum and passing through the circular fibers



THE ARTERIES OF THE ENTIRE LOWER EXTREMITY.

at the lower and back part of the capsular ligament. (b) **THE PUBO-FEMORAL LIGAMENT** is an accessory ligament and passes from the ilio-pectineal eminence to the rough tubercle in front of the lesser trochanter.

(3) The **ligamentum teres** passes from the margins of the notch at the bottom of the acetabulum to a depression on the head of the femur. It is covered by a reflection of synovial membrane and consists of connective tissue and vessels.

(4) The **cotyloid ligament** surrounds the brim of the acetabulum, making this cavity deeper. It is broad at its point of attachment and runs to a point, thus making it triangular on cross section.

(5) The **transverse ligament** is a portion of the cotyloid ligament which crosses the notch at the lower portion of the acetabulum. The nutrient vessels to the joint pass under this ligament.

The **synovial membrane** of the hip-joint is reflected over the inner surface of the capsular ligament on to the neck of the femur, and from here over to the ligamentum teres to the bottom of the acetabulum. At this point it covers some fat. As said before it frequently communicates with the bursa which is under the Psoas muscle.

The **flexors** of the hip-joint are all the muscles in the floor of Scarpa's triangle, viz., the Iliacus, Psoas magnus, Pectineus, Adductor brevis, Adductor longus. The Sartorius, the Rectus and the anterior fibers of the Gluteus medius and Gluteus minimus are also flexors of the hip-joint.

The **extensors** of this joint are the Gluteus maximus, Biceps, Semimembranosus, and Semitendinosus.

The **adductors** are the Adductor longus, Adductor brevis, Adductor magnus plus the Biceps, Gracilis, and lower part of the Gluteus maximus.

The **abductors** of this joint are the Gluteus medius, and Gluteus minimus, and the upper part of the Gluteus maximus.

The **internal rotators** are the anterior fibers of the Gluteus medius, Gluteus minimus, and Tensor fascia femoris.

The **external rotators** of this joint are all the muscles in the gluteal region except the posterior fibers of the Gluteus medius and Gluteus minimus, plus the Iliacus, the three Adductors, the Pectineus and the Sartorius.

The **tendino-trochanteric band** is a strengthening band of the hip-joint.

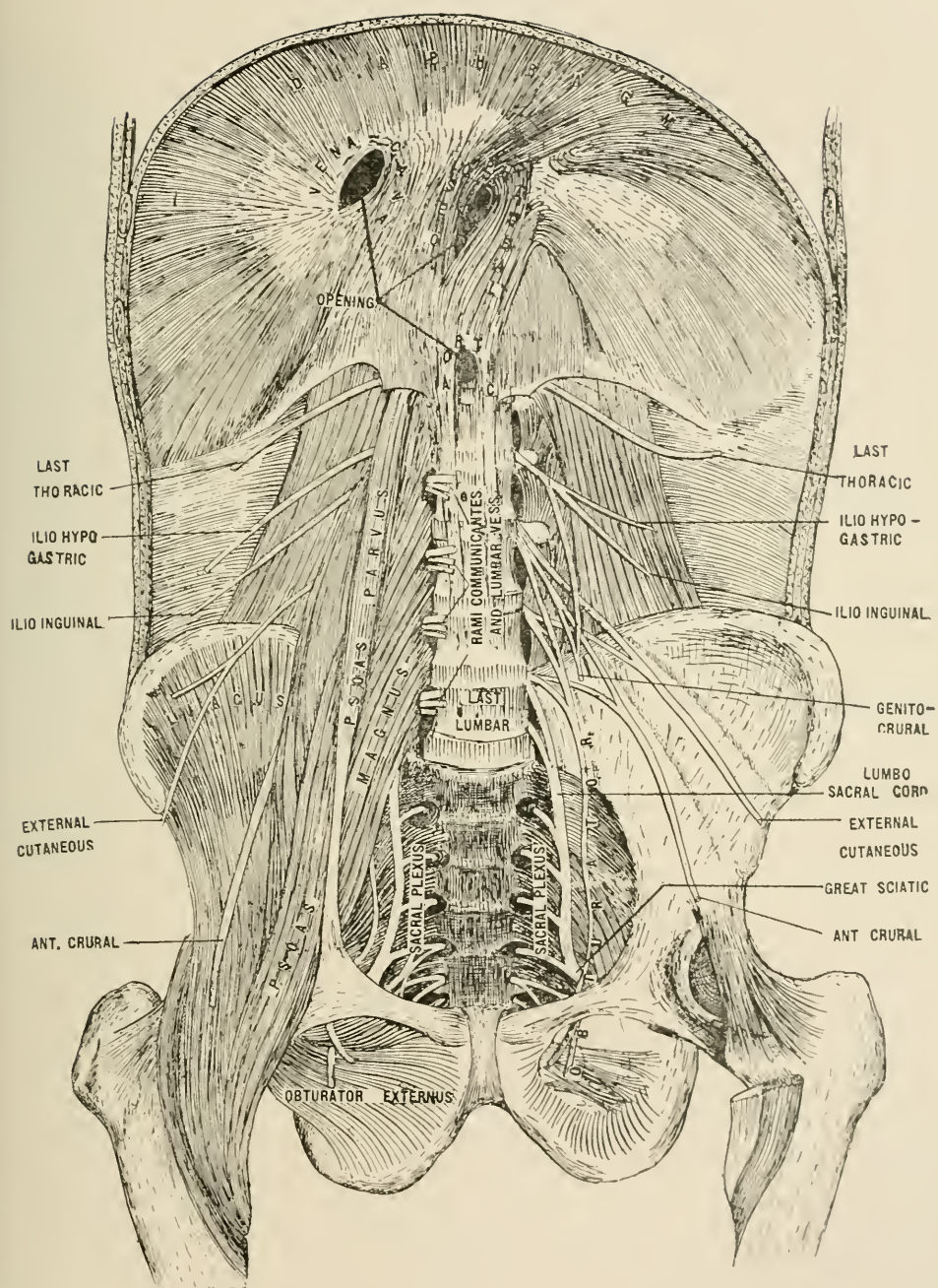
The **ligamentum teres** is an incorporated tendon of the Pectineus muscle.

Nelaton's line is a line drawn from the anterior superior spine of the ilium to the tubercle.

Bryant's triangle is a triangle made by Nelaton's line and a line drawn from the anterior superior spinous process of the ilium which meets a third line corresponding to the long axis of the femur continued.

The **blood supply** of the hip-joint is the internal circumflex, gluteal, sciatic, and obturator.

The **nerve supply** is the anterior crural, the obturator, the obturator accessory, great sciatic, and branches from the sacral plexus.



THE DIAPHRAGM, PSOAS MAGNUS AND PARVUS.

LESSON LIII.

KNEE-JOINT. (Plates LXXXIII.)

The **knee-joint** is a diarthrodial joint and belongs to the subclass ginglymus. It is a modified ginglymus joint. This joint has flexion, extension, and a slight rotation externally and internally.

Ligamentus muscles are those that cross a joint, they are also called elastic ligaments of the joint. The ligamentus muscles of the knee-joint are Biceps, Quadriiceps, Semimembranosus, Semitendinosus, Gracilis, Sartorius, Gastrocnemius, Plantaris, and Popliteus.

The **nerve supply** of this joint is the anterior crural, the obturator, the internal and external popliteal.

The **blood supply** of the knee-joint is the anastomotica magna, the five articular branches of the popliteal, the anterior and posterior tibial recurrent, and the terminal branches of the profunda.

The **flexors** of this joint are the Biceps, the Semimembranosus, Semitendinosus, Gracilis, Sartorius, and indirectly the Gastrocnemius, Popliteus, and Plantaris.

The **extensors** of this joint are the Quadriceps, plus outer rotation by the Biceps and inner rotation by the Popliteus and Semitendinosus, and to a slight degree by the Semimembranosus, Sartorius and Gracilis.

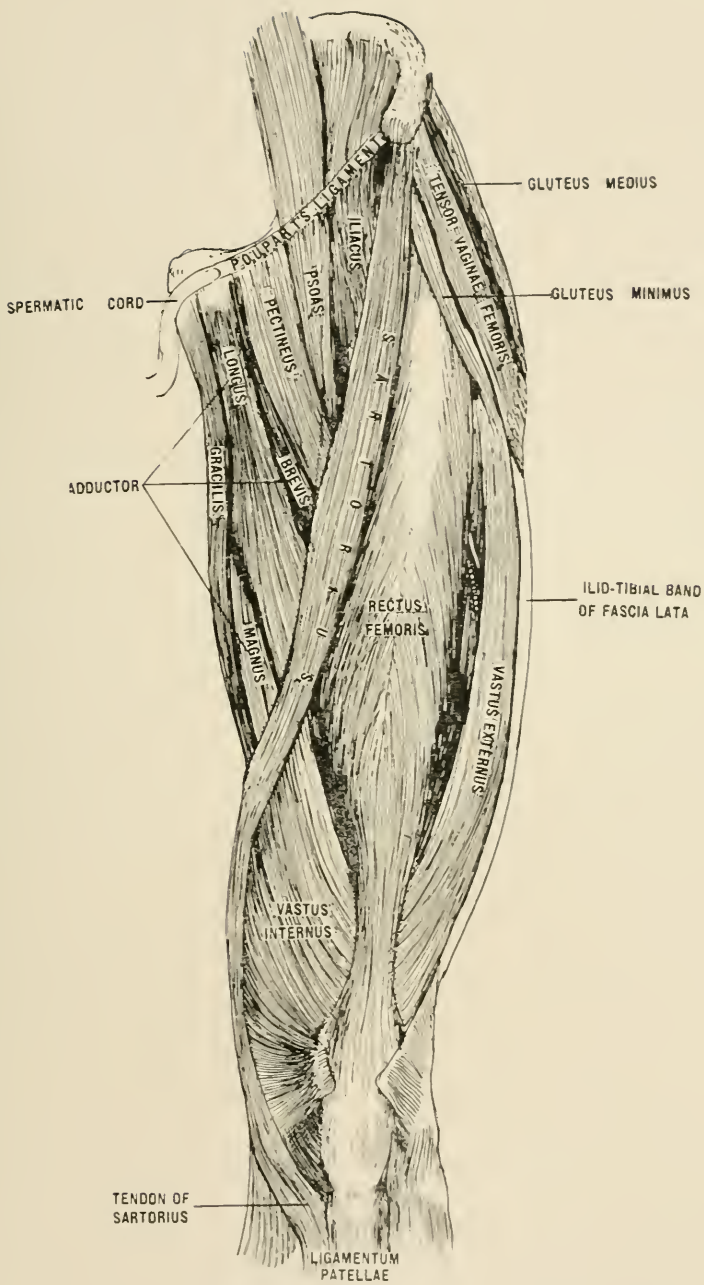
The **strengthening bands** are the Biceps, Sartorius, and Semimembranosus.

The **incorporated tendons** are the Peroneus longus and Adductor magnus. The incorporated tendon of the Peroneus longus makes the external lateral ligament of the knee-joint, and that of the Adductor magnus makes the internal lateral ligament.

The **knee-joint** is formed by the condyles of the femur, the head of the tibia, and the patella. It has fourteen ligaments, an external set in which there are six, and an internal set in which there are eight. The first of the external ligaments is the **anterior** or **ligamentum patella**, which is a continuation of the tendon of the Quadriceps extensor. (Plate LXXXIII.) It is attached above to the apex and rough surface on the lower and posterior portions of the patella, and below it is attached to the lower part of the tubercle of the tibia. A bursa is found between the upper part of the tubercle and the ligament.

The second ligament of this set is the **posterior ligament**, called the **ligamentum posticum Winslowii**, which is broad and thin and covers the back of the knee-joint. (Plate LXXXVI.) It has a central and two lateral portions, the lateral portions are attached above the condyles of the femur superiorly, and to the head of the tibia inferiorly. The central portion which is derived from an expansion of the Semimembranosus tendon and passes from the inner tuberosity of the tibia to the inner side of the upper part of the outer condyle of the femur.

The third ligament of this set is the **internal lateral ligament**, which is broad and flat and is attached above to the inner condyle of the femur and below to the margin of the inner tuberosity, to the internal fibro-cartilage, and to the



THE MUSCLES IN FRONT OF THE THIGH.

inner surface of the shaft of the fibula extending one and one-half inches. (Plates LXXXIII-LXXXVI.)

The fourth ligament of this set is the **long external lateral ligament**, which is the divorced tendon of the Peroneus longus and is now a rounded cord, being attached above to the external condyle of the femur and below to the external part of the head of the fibula. It divides the tendon of the Biceps into two portions. (Plates LXXXIV-LXXXVI.)

The fifth ligament of this set is the **short external lateral ligament**, which lies behind and almost parallel with the long external lateral ligament and it is very indistinct, being attached above to the outer condyle of the femur and below to the styloid process of the fibula.

The sixth ligament of this set is a **capsular ligament**. It fills the spaces left by these other ligaments. It is thin and is attached to the margins of the articular surfaces of the bones. It blends with the fascia of the thigh and receives expansions from the Vasti muscles above, called lateral patellar ligaments. (Plate LXXXIII.)

The following structures are on the head of the tibia from before backward in the median line. (Plate LXXXV.)

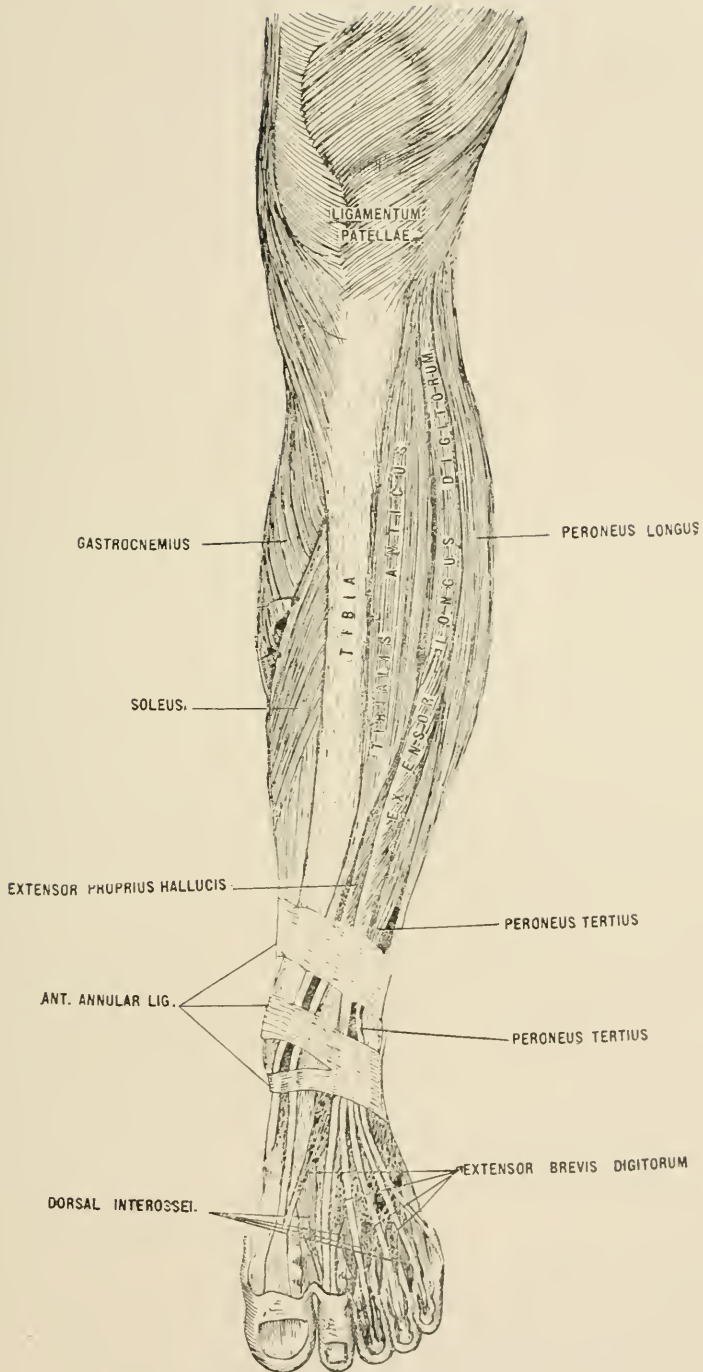
1. Transverse ligament.
2. Anterior extremity of internal semilunar cartilage.
3. Anterior crucial ligament.
4. Anterior extremity of external semilunar cartilage.
5. The spine of tibia.
6. Posterior extremity of external semilunar cartilage.
7. Posterior extremity of internal semilunar cartilage.
8. Posterior crucial ligament.

The ligaments of the internal set are eight in number.

The first ligament is the **anterior or external crucial**, which is attached to the depression in front of the spine of the tibia and to the external semilunar fibro-cartilage. It now passes upward, backward, and outward to the posterior part of the inner side of the external condyle of the femur. (Plate LXXXV.)

The second ligament of this set is the **posterior or internal crucial**, which is attached to a depression behind the spine of the tibia, to the popliteal notch, and also to the posterior border of the external semilunar fibro-cartilage. From here it passes upward, forward, and inward to be attached to the oblique curve of the inner condyle, to the fore part of the intercondylar fossa, also to the anterior part of the outer surface of the inner condyle.

The **semilunar fibro-cartilages** help to deepen the cavities which receive the condyle of the femur. They are thicker at the circumference than at the central portion. The **internal semilunar fibro-cartilage** is longer antero-posteriorly than transversely. Its anterior extremity is attached in front of the anterior crucial ligament to the tibia and the posterior extremity is attached in front of the posterior crucial ligament. The **external semilunar fibro-cartilage** is nearly circular, and its anterior extremity is attached in front of the spine to the tibia, its posterior extremity is attached to the back of the spine. (Plate LXXXV.)



MUSCLES IN FRONT OF LEG.

The **transverse ligament** passes between the anterior extremities of the semilunar fibro-cartilages and is a band of broad fibers. (Plate LXXXIV.)

The **coronary ligaments** hold the circumferences of the semilunar fibro-cartilages to the head of the tibia. (Plate LXXXIV.)

The **synovial membrane** of the knee-joint is the largest in the body. It extends over two inches above the joint under the extensor muscles and it passes over the crucial ligaments to the head of the tibia. It covers both surfaces of the semilunar fibro-cartilages and lines the capsular ligament. It gives a covering to the tendon of the Popliteus muscle.

The **ligamentum mucosum** is a fold of this membrane. It is triangular in shape, being attached to the intercondylar notch and extending to the patella.

The **ligamenta alaria** are two processes of this membrane which are on either side of the ligamentum mucosum.

LESSON LIV.

THE SUPERIOR TIBIO-FIBULAR JOINT.

This joint is an arthrodial joint. Its **anterior superior ligament** extends from the head of the fibula upward and inward to the external tuberosity of the tibia. Its **posterior superior ligament** extends from the back part of the head of the fibula upward and inward under the tendon of the Popliteus muscle to the back part of the outer tuberosity of the tibia. (Plate LXXXVI.)

The **middle tibio-fibular** articulation is formed by the interosseous membrane which is attached to the interosseous ridges of the tibia and fibula. The fibers of this membrane pass down from the tibia to the fibula. Above this membrane there is an opening for the anterior tibial vessels, and below it one for the anterior peroneal vessels.

The **inferior tibio-fibular** articulation is a syndesmosis joint. The inferior interosseous ligament which passes between the adjacent rough surfaces of the tibia and fibula is continuous above with the interosseous membrane.

The **anterior ligament** of this joint passes between the adjacent margins of the tibia and fibula and is triangular in shape. The posterior ligament is a similar band posteriorly. It is smaller than the anterior one. The **transverse** or **inferior ligament** of this joint is a narrow band which is continuous with these two ligaments and extends from the back of the external malleolus nearly to the internal malleolus and helps to deepen the ankle-joint. (Plate LXXXVII.)

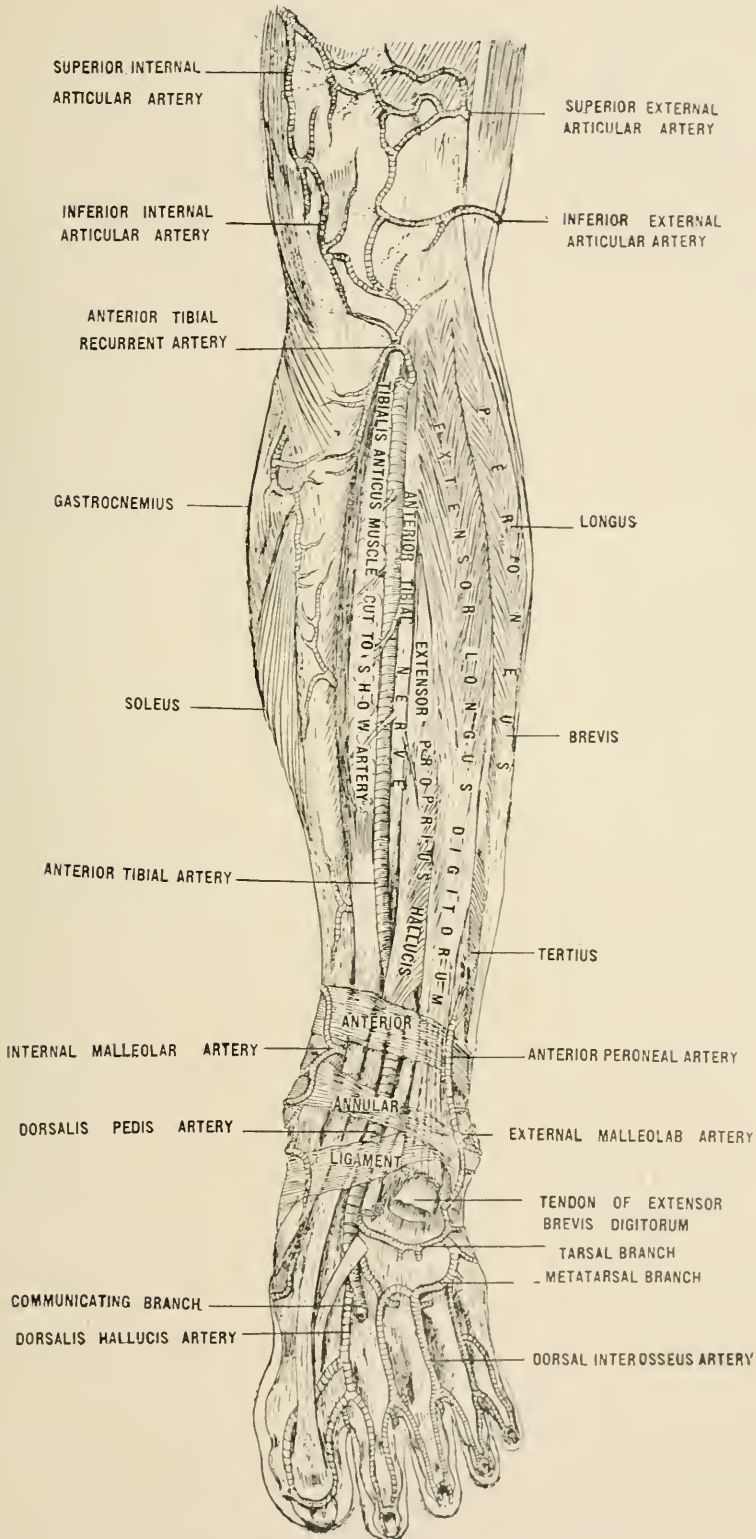
THE ANKLE-JOINT. (Plates LXXXVII-LXXXVIII.)

This joint is a ginglymus or hinge-joint, and is formed by the lower ends of the tibia and fibula and the upper surface of the astragalus.

The **anterior ligament** of this joint is connected above with the edge of the articular surface of the tibia, and below with the margin of the superior articular surface of the astragalus. This ligament is thin and broad.

The **posterior ligament** is attached above to the transverse ligament of the inferior tibio-fibular articulation and below to the back of the upper articular surface of the astragalus, most of the fibers of this ligament are transverse.

The **internal lateral ligament** is called the deltoid ligament and consists



ARTERIES AND NERVES IN FRONT OF LEG.

of two main parts. First a **superficial part** which is attached by its apex to the internal malleolus and by its base to the inner side of the astragalus and the sustentaculum tali posteriorly, while anteriorly it is attached to the tuberosity of the scaphoid and blends with the inferior calcaneo-scaphoid ligament. The second, a **deep portion** which passes from the apex of the malleolus to the side of the astragalus.

The **external lateral ligament** consists of three portions. The first is an **anterior fasciculus** which passes between the front of the external malleolus and the side of the astragalus in front of the superior articular process.

The second is a **middle fasciculus** which passes from the apex of the external malleolus to the outer side of the os calcis.

The third is a **posterior fasciculus** which is attached behind the deep groove on the posterior part of the outer malleolus and from this point passes inward to a depression on the posterior surface of the astragalus.

The synovial membrane of the ankle-joint lines the inner surfaces of its ligaments, and from there it is reflected on the two articular surfaces of the bones forming the joint. It sends a prolongation into the inferior tibio-fibular articulation.

The ligamentous muscles of the ankle-joint are all the muscles from the knee to the ankle except the Popliteus.

The **nerve supply** is the anterior tibial, posterior tibial and internal saphenous.

The **blood supply** is the anterior tibial, posterior tibial and peroneal.

LESSON LV.

THE JOINTS OF THE TARSUS. (Plates LXXXVII-LXXXVIII.)

All **these joints** are arthrodial except the articulation between the navicular and the astragalus, which is an enarthrodial joint.

THE LIGAMENTS BETWEEN THE OS CALCIS AND THE ASTRAGALUS ARE:

- (1) Anterior calcaneo-astragaloid ligament.
- (2) Interosseous calcaneo-astragaloid ligament.
- (3) External calcaneo-astragaloid ligament.

THE LIGAMENTS BETWEEN THE OS CALCIS AND SCAPHOID ARE:

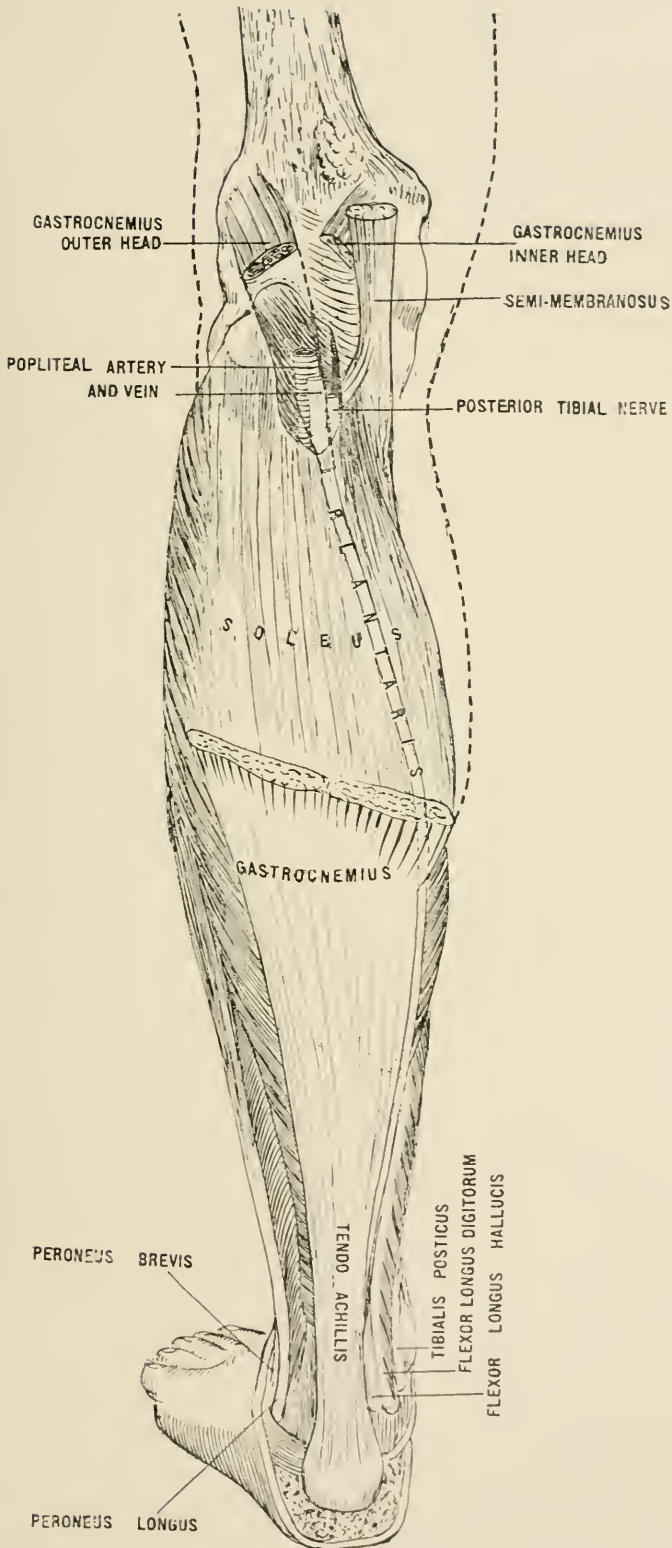
- (1) Superior or dorsal calcaneo-scaphoid ligament.
- (2) Inferior calcaneo-scaphoid ligament.

BETWEEN THE ASTRAGALUS AND THE SCAPHOID THERE IS BUT ONE LIGAMENT.

- (1) The superior or dorsal astragalo-scaphoid ligament.

THE LIGAMENTS BETWEEN THE SCAPHOID, CUBOID, AND THE THREE CUNEIFORM ARE:

- (1) Superior or Dorsal scapho-cuboid ligament.
- (2) Superior or Dorsal scapho-cuneiform ligament.
- (3) Superior or Dorsal intercuneiform ligament.
- (4) Superior or Dorsal cubo-cuneiform ligament.
- (5) Internal lateral scapho-cuneiform ligament.
- (6) The plantar ligaments are similarly arranged upon the bottom of the foot.



MUSCLES IN BACK OF LEG (SUPERFICIAL LAYER)

(7) There are four strong interosseous ligaments passing between the rough non-articular surfaces of these bones.

THE LIGAMENTS BETWEEN THE OS CALCIS AND CUBOID ARE:

- (1) Superior or dorsal calcaneo-cuboid ligament.
- (2) Inferior calcaneo-cuboid ligament.
- (3) Internal calcaneo-cuboid ligament.
- (4) External calcaneo-cuboid ligament.

There is the **long calcaneo-cuboid ligament** also called *ligamentum longum plantar*. This ligament passes between the under surface of the os calcis in front of the tuberosities to the posterior margin of the peroneal groove of the cuboid. Some of the fibers pass over the sheath of the tendon of the *Peroneus longus* and are attached to the bases of the second, third, and fourth metacarpal bones.

The **short calcaneo-cuboid ligament** passes from the tubercle and depression on the under surface of the os calcis to the under surface of the cuboid behind the peroneal groove.

THE JOINTS OF THE TARSUS AND METATARSUS.

THE LIGAMENTS OF THESE JOINTS ARE:

- (1) Dorsal tarso-metatarsal ligament.
- (2) Dorsal intermetatarsal ligaments.
- (3) Internal lateral tarso-metatarsal ligaments.
- (4) The plantar ligaments are arranged irregularly between these bones.

THE INTEROSSEOUS LIGAMENTS WHICH ARE STRONG BANDS ARE THREE IN NUMBER:

- (1) The internal one passes from internal cuneiform to the second metatarsal.
- (2) The middle one passes between the external cuneiform and the second metatarsal.
- (3) The external one connects the external cuneiform and the third metatarsal.

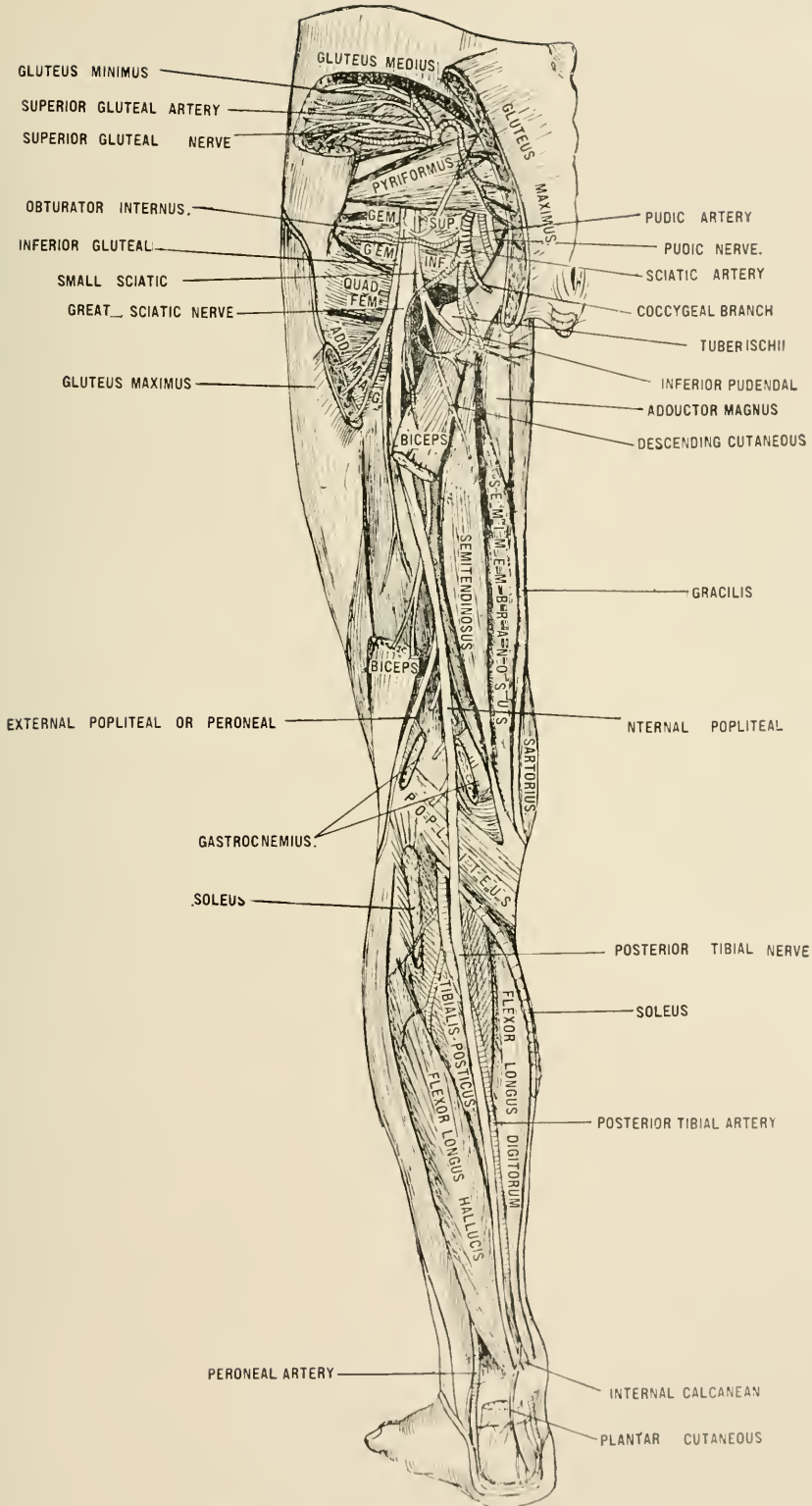
THERE ARE SIX SYNOVIAL MEMBRANES OF THE TARSUS AND METATARSUS:

- (1) One for the posterior calcaneo-astragaloid articulation.
- (2) One for the anterior calcaneo-astragaloid articulation and the scapho-astragaloid articulation.
- (3) One for the calcaneo-cuboid articulation.
- (4) One for the articulation of the scaphoid and the three cuneiform bones; the cuneiform bones with each other; the external cuneiform and the cuboid; and the middle and external cuneiform bones with the bases of the second and third metatarsal bones.
- (5) One between the first metatarsal and internal cuneiform bones.
- (6) One for fourth and fifth metatarsal with the cuboid.

The **bases** of the metatarsal bones are joined by dorsal, plantar, and interosseous ligaments.

The **digital ends** are joined by the transverse metatarsal ligament, which connects the first metatarsal with the others, similar to those in the hand.

The **metatarso-phalangeal** and **phalangeal** articulation are similar to the corresponding parts of the hand.



POSTERIOR VIEW OF ENTIRE LEG.

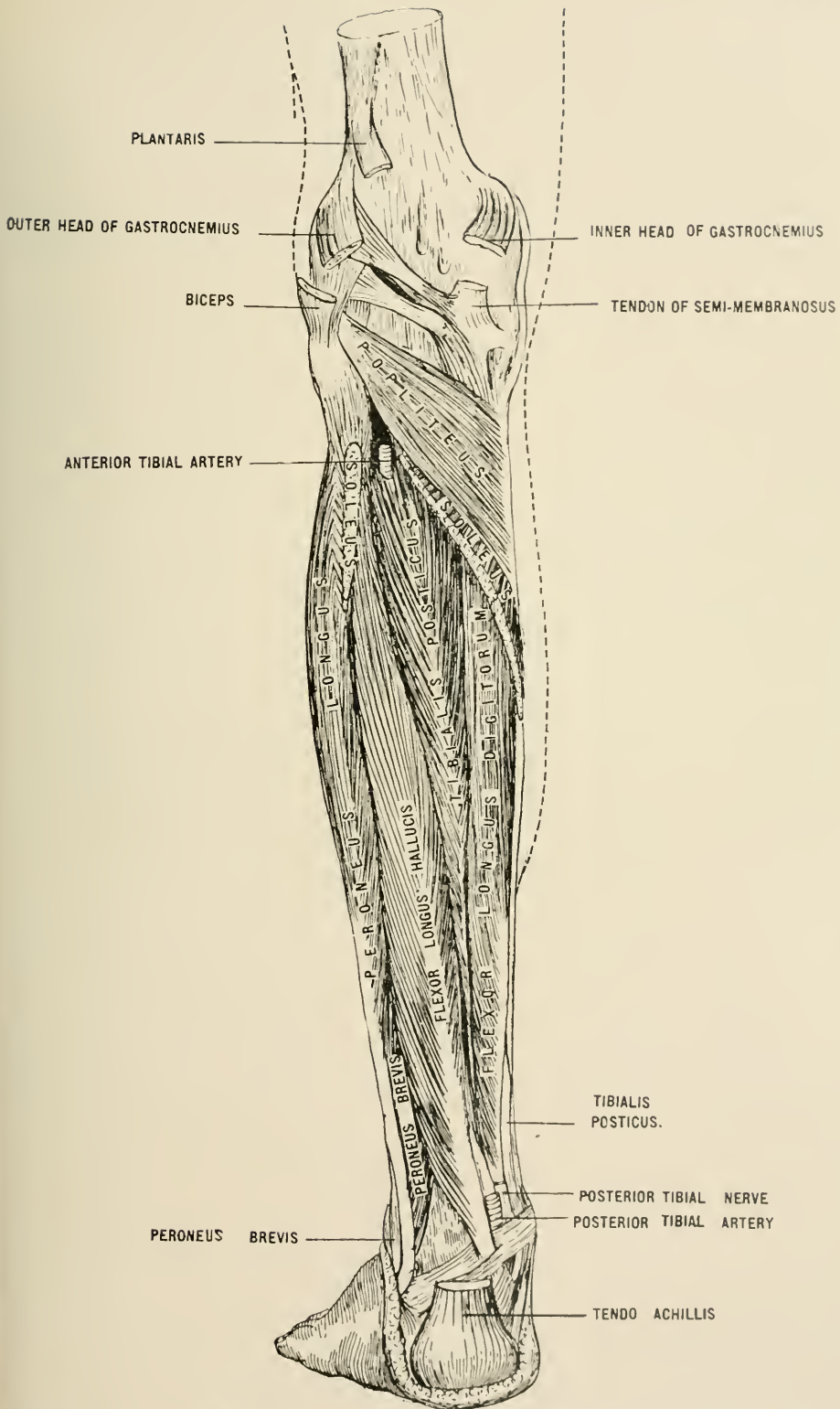
LESSON LVI.

LUMBAR PLEXUS. (Plates LXIII-LXXIII.)

The **lumbar plexus** is made of the anterior branches of the first, second, third, and a greater part of the fourth lumbar nerves. The twelfth dorsal nerve sends a communicating branch to the first lumbar nerve. This plexus lies in the posterior part of the Psoas magnus muscle in front of the transverse processes of the lumbar vertebrae.

The **first lumbar nerve** divides into two branches, the ilio-hypogastric and the ilio-inguinal. (Plate LXXIII.) The **ilio-hypogastric nerve** passes through the outer border of the Psoas magnus in front of the Quadratus lumborum and behind the kidney and the large intestine. It pierces the Transversalis muscle at the outer border of the Quadratus lumborum to enter the areolar tissue between the transversalis muscle and the Internal oblique. At this point it frequently joins the last dorsal and inguinal nerve. It divides into a hypogastric branch and an iliac branch. The hypogastric branch passes between the Transversalis and the Internal oblique muscles forward and downward and gives branches to each of these muscles. It joins the ilio-inguinal nerve and pierces the Internal oblique muscle near the anterior superior spine of the ilium and passes beneath the aponeurosis of the External oblique towards the median line. It pierces the aponeurosis of the External oblique muscle about an inch above the external abdominal ring and becomes cutaneous to supply the skin over the symphysis. The iliac branch pierces both the Internal oblique muscle and the External oblique. The point where it pierces the External oblique muscle is above the crest of the ilium a little in front of its middle portion. It supplies the integument near the Gluteus medius muscle and the Tensor fascia femoris. The **ilio-inguinal nerve** passes out of the Psoas magnus muscle a little below the hypogastric, and then crosses the Quadratus lumborum to pass behind the large intestine, after which it crosses the inner lip of the crest of the ilium posteriorly. It now takes a forward course on the upper part of the Iliacus muscle to pierce the Transversalis muscle near the anterior part of the crest of the ilium where it communicates with the hypogastric branch of the ilio-hypogastric nerve. It passes through the inguinal canal and gives a branch to the spermatic cord, and to the skin of the upper and middle part of the thigh and to the scrotum and penis in the male, or to the mons veneris and the major lip in the female.

The **second nerve** of the lumbar plexus is the **genito-crural**, which comes from the first and second lumbar nerves, mostly from the second. It passes through the Psoas magnus muscle coming out on the anterior surface of this muscle at the level of the lower border of the third lumbar vertebra. It now passes downward on the outer side of the abdominal aorta and the common iliac artery, then behind the ureter where it divides into an external or genital branch and an internal or crural branch. THE EXTERNAL OR GENITAL BRANCH gives a branch to the external iliac artery and it turns round the deep epigastric artery at Poupart's ligament. It now enters the inguinal canal with the spermatic cord in the male or the round ligament in the female. The Cremas-



MUSCLES OF BACK OF LEG (DEEP LAYER).

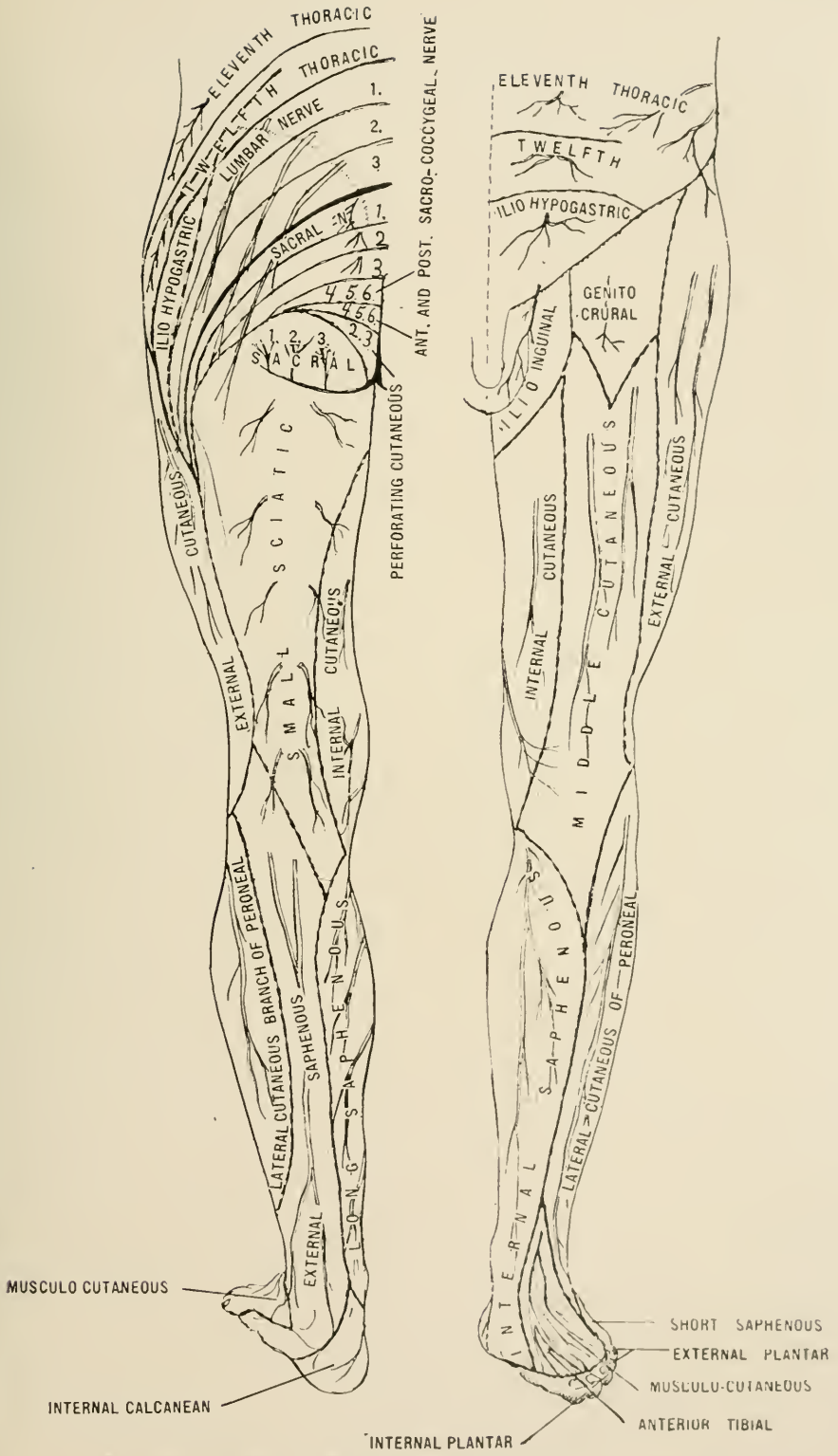
teric muscle is supplied by this nerve, it also sends branches to the integument of the scrotum in the male or the major lip in the female. THE INTERNAL OR CRURAL BRANCH passes beneath Poupart's ligament on the outer side of the femoral artery. It pierces the fascia lata to supply the integument in the middle of the upper third of the thigh.

The **third nerve** of the lumbar plexus is the **external cutaneous**, which comes from the second and third lumbar nerves. After passing from the outer border of the Psoas magnus muscle it crosses the Iliacus muscle, prior to this it passes behind the cæcum on the right side and the iliac colon on the left. Below the anterior superior spine of the ilium it passes under Poupart's ligament in the outer border of Scarpa's triangle. It now crosses in front of the Sartorius muscle where it divides into two branches, an anterior and a posterior branch. THE ANTERIOR BRANCH, after passing in the deep fascia for about four inches, becomes cutaneous, and most always divides into an external branch which supplies the skin of the lower half of the outer side of the thigh, and an internal branch which is distributed to the skin of the outer side of the front of the thigh as far as the knee. THE POSTERIOR BRANCH supplies the integument of the outer side of the thigh from the greater trochanter to the middle of the thigh.

The **patellar plexus** is formed by branches from the long saphenous and internal cutaneous and middle cutaneous, and external cutaneous.

LESSON LVII.

The **fourth nerve** of the lumbar plexus is the **anterior crural**, which is the largest nerve of this plexus. It comes from the anterior branches of the second, third, and fourth nerve, and after passing through the outer border of the Psoas magnus muscle, it passes under Poupart's ligament in a groove between the Psoas magnus and Iliacus muscle into Scarpa's triangle. In this triangle it lies to the outer side of the femoral artery from which it is separated by part of the Psoas magnus. Here it divides into superficial and deep branches, between which passes the external circumflex artery. THE SUPERFICIAL BRANCHES supply the Pectineus and Sartorius muscle and give off two cutaneous branches, middle and internal. THE DEEP BRANCHES supply the Iliacus, the Rectus femoris, Vastus internus, Vastus externus, Cræus and Suberureus muscle, and gives off the internal or long saphenous nerve which is cutaneous. This **anterior crural nerve** passes to eight muscles, all the muscles on the front of the leg except the Tensor fascia femoris, and in its place it supplies the Iliacus of the deep abdominal region. It supplies the Pectineus of the internal femoral region. The nerve to the Pectineus passes behind the femoral sheath and in front of the Psoas magnus to end in the anterior surface of the Pectineus. The nerve to the Sartorius ends in the upper part of the muscle. THE MIDDLE CUTANEOUS NERVE divides into two branches, the outer one of which pierces the Sartorius and it together with the inner branch becomes cutaneous at the upper third of the thigh, and the two **pass down as far as the knee-joint** where they enter into the patellar plexus. THE INTERNAL CUTANEOUS BRANCH divides into an anterior and posterior division and supplies integument on the inner side of



CUTANEOUS NERVE SUPPLY OF THE LOWER EXTREMITY.

the thigh from the middle of the thigh to the knee. The posterior one of these branches helps to form the **subsartorial plexus** which lies on the roof of Hunter's canal. The other nerves in the subsartorial plexus are the long saphenous, and branches from the obturator.

The muscular branch which passes to the Rectus muscle sends an **articular branch** to the hip-joint, while the muscular branch to the Vastus internus sends an **articular branch** to the knee-joint. The long saphenous nerve sends an **articular branch** to the ankle-joint.

The **blood supply** of the lumbar plexus comes from the ilio-lumbar arteries.

The **obturator nerve** is derived from the second, third and fourth sacral nerves. Its largest root is from the third nerve. After it passes from the substance of the inner border of the Psoas magnus muscle at the posterior part of the brim of the pelvis, the ilio-lumbar artery separates it from the lumbo-sacral cord. It now crosses the internal iliac vessels and the ureter, passing in the extraperitoneal fat below the obliterated umbilical (hypogastric) artery, along the inner surface and upper part of the Obturator internus muscle. It now passes through the obturator foramen above the obturator membrane. In the pelvis it lies above the obturator artery. After passing out of the pelvis it divides into two branches, an anterior and a posterior division. **THE ANTERIOR DIVISION** crosses the Obturator externus muscle and passes between the Pectineus and Adductor brevis. It sends (1) an articular branch to the hip-joint, (2) a branch to the femoral artery, which is an example of the gray rami, (3) Cutaneous branch to the subsartorial plexus, (4) muscular branches to the Adductor longus, Adductor brevis, the Gracilis and the Pectineus muscle. **THE POSTERIOR DIVISION** passes between the Adductor brevis and Adductor magnus after piercing the upper part of the Obturator externus. It gives off (a) muscular branches to the Obturator externus and Adductor magnus, and (b) articular branches to the hip-joint and knee-joint.

Obturator accessory nerve, which is present in a little more than one-fourth of the cases, comes from the second and third lumbar nerves. It passes along the inner border of the Psoas muscle between the roots of the anterior crural and obturator nerves. It does not pass through the obturator foramen, but passes in front of the brim of the pelvis beneath the Pectineus muscle. Its branches are (1) a communicating branch to the obturator nerve, (2) an articular branch to the hip-joint, and (3) a muscular branch to the Pectineus.

LESSON LVIII.

SACRAL PLEXUS. (Plates LXIII-LXXIII.)

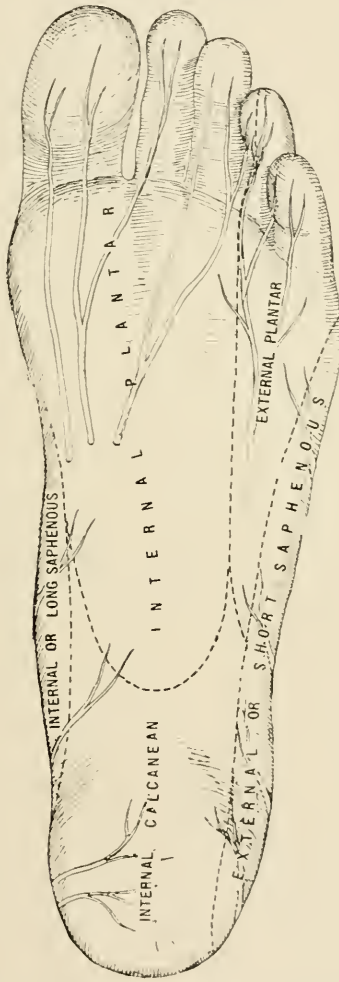
The **sacral plexus** is formed by the lumbo-sacral cord and the anterior branches of the first, second, third, and a part of the fourth sacral nerves.

The lumbo-sacral cord is formed by a part of the fourth lumbar nerve and all of the fifth lumbar nerve.

This plexus is situated on the anterior surface of the Piriformis muscle and behind the pelvic fascia and the branches of the internal iliac artery. It gives off (A) visceral branches, (B) muscular, (C) cutaneous, (D) terminal branches. (E) Great sciatic and its branches.

Under (A) **visceral branches**, we have branches to the pelvic viscera from the second, third, and fourth sacral nerves. Under (B) **muscular branches**. (1) **THE NERVE** to the Piriformis comes from the first and second sacral nerves. This nerve leaves the pelvis through the great sacro-sciatic foramen, and after crossing the spine of the ischium enters the Piriformis muscle on its internal surface.

PLATE LXXXI.



CUTANEOUS NERVE SUPPLY OF THE PLANTAR SURFACE OF THE FOOT.

(2) **THE SUPERIOR GLUTEAL NERVE** is derived from the fourth and fifth lumbar and first sacral nerve. It leaves the pelvis above the Piriformis muscle with the gluteal vessels. It supplies the Gluteus medius, Gluteus minimus and Tensor fascia femoris. It also sends sympathetic branches, which are gray rami, to the bone, ligament, fascia, and vessels—see sympathetic nerve.

(3) THE INFERIOR GLUTEAL NERVE is derived from the fifth lumbar, first and second sacral nerves. It leaves the pelvis below the Piriformis muscle with the sciatic and pudic vessels and nerves. It gives muscular branches to the Gluteus maximus.

(4) THE NERVE to the Quadratus femoris is derived from the fourth, fifth lumbar, and first sacral nerves. It leaves the pelvis below the Piriformis muscle. It sends a branch to the Gemellus inferior, and also one to the hip-joint.

(5) The nerve to the Obturator internus is derived from the fifth lumbar, first and second sacral nerves. It leaves the pelvis below the Piriformis muscle and re-enters the pelvis through the lesser sacro-sciatic foramen to be distributed to the inner surface of this muscle. It gives a branch to the Gemellus superior.

Under (C) **cutaneous branches** we have, (Plate LXXVIII.)

(1) The **small sciatic** is derived from the first, second, and third sacral nerves. It leaves the pelvis through the great sacro-sciatic foramen below the Piriformis muscle with the sciatic vessels and the great sciatic nerve, inferior gluteal nerve, internal pudic nerve and vessels. At the lower border of the Gluteus maximus it passes behind the long head of the Biceps and descends beneath the deep fascia to the popliteal space. Some say it supplies the Gluteus maximus, but outside of supplying this one muscle it is cutaneous. Its branches are **first**; peroneal cutaneous which supplies the skin of the upper, inner, and posterior aspects of the thigh and perineum. One of these branches, the **inferior** or **long pudendal nerve**, crosses the tuberosity of the ischium and perforates the fascia lata and Colles' fascia to enter the anterior compartment of the perineum. In the perineum it communicates with the superficial perineal nerves and sends branches to the skin of the scrotum in the male, and to the major lip in the female. **Second**; Femoral cutaneous branch which supplies the integument on the central, inner and outer aspects of the posterior part of the thigh. **Third**; Gluteal or ascending cutaneous branches to supply the skin over the lower and outer part of the Gluteus maximus.

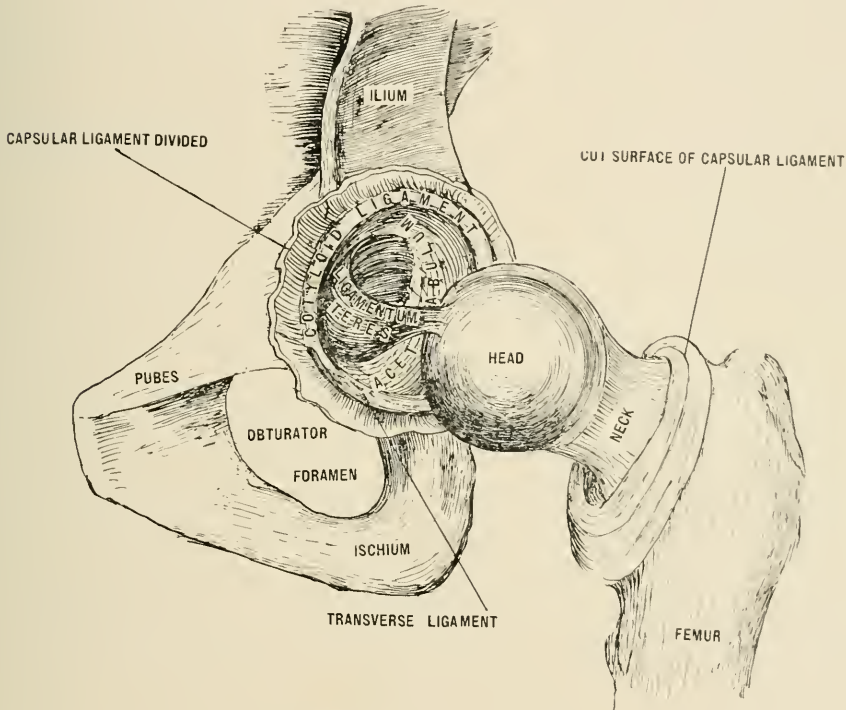
(2) **Perforating cutaneous nerve** is derived from the second and third sacral nerves. It perforates the greater sacro-sciatic ligament and supplies the skin over the lower and inner part of the Gluteus maximus.

Under (D) **terminal branches** we have.

(1) The **pudic nerve** is derived from the second, third and fourth sacral nerves. It leaves the pelvis below the Piriformis muscle. It now crosses the spine of the ischium, being on the inner side of the internal pudic artery, which it accompanies through the lesser sacro-sciatic notch into Alcock's canal where it divides into three branches. **First**; the inferior hemorrhoidal nerve which passes through the inner wall of Alcock's canal towards the anus to supply the sphincter ani and the adjacent integument. **Second**; the perineal branch which has a cutaneous branch called the superficial perineal. It leaves Alcock's canal and pierces the base of the triangular ligament and is distributed to the skin of the scrotum in the male or the major lip in the female. **Third**; the dorsal nerve of the penis, pierces the posterior layer of the triangular ligament and

passes through the deep perineal space along the inner margin of the ramus of the pubic bone. It now pierces the anterior layer of the triangular ligament, lying between the crus penis and the pubic bone, and gives a vaso-motor branch to the corpus cavernosum, and passes to the dorsum of the penis to supply the integument, glans and prepuce in the male or clitoris in the female. It is called the dorsal nerve of the clitoris in the female and is much smaller.

PLATE LXXXII.



LIGAMENTS OF HIP-JOINT.

LESSON LIX.

Under (E) great sciatic nerve and its branches we have, (Plate LXXVIII.)

(1) The **great sciatic nerve** and its branches which supply both muscles and integument below the knee-joint but muscles only above this joint. It supplies thirty-seven muscles in all. It is the largest nerve in the body and is a continuation of the sacral plexus, except the fourth sacral nerve, since the great sciatic is formed by the lumbo-sacral cord and the anterior branches of the first, second and third sacral nerves. After passing out of the pelvis below the Piriformis muscle it passes between the great trochanter and the tuberosity of the ischium. It may perforate the Piriformis muscle. It generally divides at the lower one-third of the thigh into an external popliteal or peroneal and an internal popliteal or popliteal nerve. This division may take place immediately after the nerve leaves the pelvis. In its course down the back of the thigh (Plate LXXVIII) it

lies upon the back of the ischium, the nerve to Quadratus femoris, the Gemelli muscles, Obturator internus, Quadratus femoris, and Adductor magnus muscles. It is accompanied by the sciatic artery and the small sciatic nerve. In the upper part of its course it is covered by the Gluteus maximus and in its lower part by the long head of the Biceps. Before it divides it gives, (a) **ARTICULAR BRANCHES** to the hip-joint which perforates the capsular ligament posteriorly, (b) **MUSCULAR BRANCHES** beneath the long head of the Biceps to the Biceps, Semitendinosus, Semimembranosus, and Adductor magnus. The fibers in the **internal popliteal** or **popliteal** are from the fourth and fifth lumbar, first, second, and third sacral. (Plate LXXVII.) This is the larger of the two divisions, it passes through the popliteal space. At the lower border of the Popliteus muscle it is called the posterior tibial nerve. It is like the median nerve of arm in that it lies at first on the outer side of the artery, then crosses it to lie on its inner side. It gives off the following branches, (1) **ARTICULAR BRANCHES** to the knee-joint which are three in number: first, superior internal; second, superior external, and third, azygos.

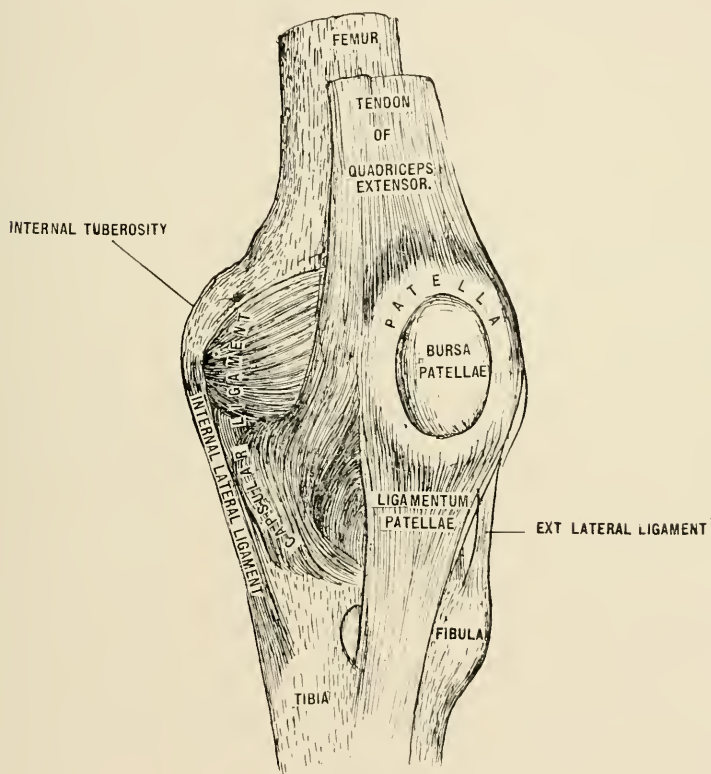
(2) **MUSCULAR BRANCHES** to the Gastrocnemius, Plantaris, Popliteus, and Soleus.

(3) **COMMUNICANS POPLITEI** which joins the communicans peronei to form the short saphenous nerve, which supplies integument on the posterior part of the leg and on the outer side of the foot. (4) This nerve continues as the **POSTERIOR TIBIAL** after it passes the lower border of the Popliteus muscle. The **posterior tibial** nerve crosses the posterior tibial vessels from within out, just the opposite from the median and popliteal nerves. (Plate LXXVIII.) In the lower part of the leg these posterior tibial vessels and the nerve lie parallel with the inner border of the tendo Achillis. The branches of this nerve are, (1) **MUSCULAR** to the Soleus, Tibialis posticus, Flexor longus hallucis, Flexor longus digitorum. (2) **INTERNAL CALCANEAN** (cutaneous) which passes with the internal calcanean artery. It supplies the integument and fascia of the heel and a part of the sole. (3) **ARTICULAR BRANCHES** to the ankle. (4) **INTERNAL AND EXTERNAL PLANTAR NERVES**, which are formed by the division of the posterior tibial nerve at a point midway between the internal malleolus and inner tubercle of the os calcis. These nerves accompany the internal and external arteries. While the internal plantar nerve is larger than the external plantar, the arteries are just the reverse, the external being larger than the internal. The **internal nerve** supplies the following five muscles, (1) Abductor hallucis, (2) Flexor brevis digitorum, (3) and (4) the two inner Lumbricales. (5) Flexor brevis hallucis. It also supplies integument on the inner aspect of the plantar surface of the foot. (Plate LXXXI.) The **external plantar** nerve supplies the following fourteen muscles, (1) Abductor minimi digiti, (2) and (3) the two outer Lumbricales, (4) Flexor accessorius, (5) Flexor brevis minimi digiti, the seven Interossei make twelve, (13) the Adductor transversus hallucis, and (14) the Adductor obliquus hallucis. This nerve also supplies integument on the plantar surface of the foot.

LESSON LX.

The **external popliteal** or **peroneal nerve** passes along the outer part of the popliteal space close to the tendon of the Biceps muscle as far as the head of the fibula. (Plate LXXVIII.) It is about half as large as the popliteal nerve. It gives (1) **ARTICULAR BRANCHES** to the knee-joint (superior and inferior external) also recurrent articular branch to the superior tibio-fibular articulation (2) **CUTANEOUS BRANCHES** which supply the integument along the back part and outer side of the leg. (3) **COMMUNICANS PERONEI** which joins the communicans poplitei to form the short saphenous nerve. **Musculo-cutaneous**

PLATE LXXXIII.



LIGAMENTUM PATELLA.

which begins on the head of the fibula and passes down between the Peronei muscles and the Extensor brevis digitorum pierces the deep fascia at the lower one-third of the leg on its front and outer side. This nerve supplies the Peroneus longus, Peroneus brevis, and the integument on the dorsum of the foot. The **INTERNAL TERMINAL BRANCH** of the musculo-cutaneous nerve passes in front of the ankle-joint and divides into two branches. The inner branch passes to the inner side of the great toe and sends twigs to the integument on the inner side of the foot. The outer branch passes to the base of the cleft

between the second and third toes and divides to supply the adjacent sides of the cleft.

THE EXTERNAL TERMINAL BRANCH is the smaller of the two and passes along the outer side of the dorsum of the foot and divides into two branches. The inner one supplies the integument of the adjacent sides of the third and fourth toes. The outer one supplies the integument on the adjacent sides of the fourth and fifth toes. The outer side of the fifth toe receives the short saphenous nerve.

The **anterior tibial nerve** comes from the end of the peroneal nerve just internal to the musculo-cutaneous between the Peroneus longus and the neck of the fibula. It passes forward and inward beneath the Extensor longus digitorum to lie in the interval between this muscle and the Tibialis anticus. It descends on the interosseous membrane with the anterior tibial artery to the front of the ankle-joint where it divides into an inner and an outer terminal branch. The inner terminal branch passes down along the dorsalis pedis artery and supplies the integument along the adjacent sides of the first and second toes. It also supplies the periosteum of the adjacent bones, the metatarsophalangeal and inter-phalangeal joints. It helps to supply the First dorsal interosseous muscle. The outer terminal branch passes under the Extensor brevis digitorum outward. This branch has a ganglion upon it which supplies the Extensor brevis digitorum, tarsal joints and the bones, periosteum, and joints of the three outer intermetatarsal spaces. It helps to supply the Second dorsal interosseous muscle.

The **anterior tibial nerve** gives (1) MUSCULAR BRANCHES to Tibialis anticus, Extensor longus digitorum, Extensor proprius hallucis, Peroneus tertius, Extensor brevis digitorum, and as said before helps to supply two inner Dorsal interossei. (2) ARTICULAR BRANCHES to the inferior tibio-fibular articulation and the ankle-joint. (Plate LXXVI.)

The **coccygeal plexus** (Plate LXIII-LXXIII.) is formed by the anterior branches of part of the fourth sacral nerve, the fifth sacral and the coccygeal nerve. It is situated on the inner surface of the Coccygeus muscle and behind the Second portion of the rectum. Its muscular branches supply the Coccygeus muscle and Levator ani, while its visceral branches together with the sympathetic supply the pelvis viscera. For the complete distribution of the cutaneous nerve supply of the lower limb see (Plates LXXX-LXXXI.)

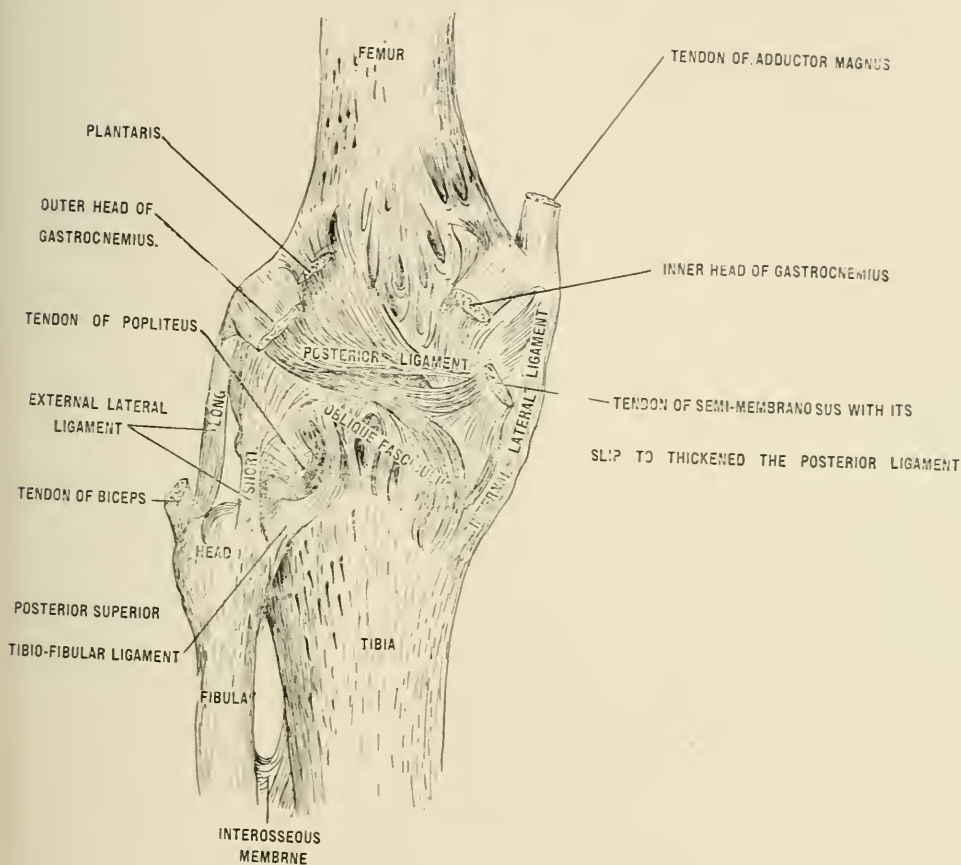
LESSON LXI.

THE SUPERFICIAL FASCIA OF THE THIGH.

The **superficial fascia** is continuous with that of the leg below and that of the abdomen above. It has an superficial and a deep layer, between which layers are the superficial vessels and nerves. Really these structures are in the deep layer but the line of distinction cannot be closely drawn between the superficial deep layers. This fascia is beneath the integument and forms an investment for the entire thigh. It is attached (1) to the margin of the saphenous opening, (2) to the femoral sheath through the saphenous opening, (3) to the fascia lata below Poupart's ligament. The **cribriform fascia**, which forms one of the coverings of a femoral hernia, is that part of the superficial

fascia which covers the saphenous opening. This fascia is perforated by the long saphenous vein and a number of vessels. The superficial fascia has a very intimate attachment to the deep fascia below Poupart's ligament, thus in extravasation of urine, it cannot pass down into the superficial fascia of the thigh.

PLATE LXXXIV.



POSTERIOR LIGAMENT OF KNEE-JOINT.

DEEP FASCIA OF THE THIGH.

The **deep fascia** of the thigh is called fascia lata, and forms a strong covering for the thigh beneath the skin and superficial fascia. It is thick in front and externally, but thin behind and internally. The Gluteus maximus, the Tensor fascia femoris, the Biceps, the Sartorius, and Quadriceps extensor muscles give expansions to the fascia lata. The **fascia lata** is attached to Poupart's ligament and the body of the pubic bone anteriorly, to the tuberosity of the ischium and the rami of the pubes and ischium internally, to the back of the sacrum and coccyx posteriorly, to the head of the fibula, tuberosities of the tibia, and condyles of the femur distally. The **external intermuscular septum**

is attached to the linea aspera and extends from the insertion of the Gluteus maximus to the outer condyle of the femur. It separates the Vastus externus from the short head of the Biceps and gives attachment to both of these muscles. The **internal intermuscular septum** is attached to the linea aspera and extends from the lesser trochanter to the adductor tubercle, thus separating the Vastus internus from the Pectineus and Adductors. This intermuscular septum is perforated by branches of the profunda artery which pass to the hamstring muscles and by the superficial femoral artery which passes into the popliteal space through an opening in the Adductor magnus. Smaller septa are given off from the fascia lata to ensheath each muscle.

The **ilio-tibial band** (Plate LXXIV.) is a special part of the fascia lata which passes from the front part of the crest of the ilium down the thigh as two layers, one superficial to and the other beneath the Tensor fascia femoris, at the lower end of which muscle these two layers become blended and having received the insertion of this muscle it passes down to be inserted into the external tuberosity of the tibia. Another special portion of the fascia lata is called the **gluteal aponeurosis** and takes its origin from the outer lip of the crest of the ilium posterior to the ilio-tibial band. This fascia covers the Gluteus medius muscle and divides at the anterior border of the Gluteus maximus to enclose it. The **iliac portion** of the fascia lata is behind the femoral vessels but in front of the pubic portion. This portion is attached to the crest of the ilium and to the whole length of Poupart's ligament and to the ilio-pectineal line with Gimbernat's ligament where it is continuous with the iliac fascia. The **pubic portion** of the fascia is attached above to the ilio-pectineal line. It passes beneath the femoral vessels to which it is attached and crosses the Gracilis, Adductor longus and Pectineus muscles. The **saphenous opening** is between the iliac and pubic portions of the fascia lata and leads from the space of the superficial fascia to the femoral vessels. It is an oval shaped aperture which is about an inch and a half in length and half an inch in width. It is directed obliquely downward and outward at the upper and inner part of the thigh just below Poupart's ligament. The inner boundary of the opening is posterior to the outer margin and behind the femoral vessels. It is through the saphenous opening that a femoral hernia passes after descending along the crural canal. The outer margin of this opening forms the **falciform process** which passes in front of the femoral vessels and is attached to Poupart's ligament and the spine of the os pubes and the pectineal line where it is continuous with the pubic portion.

LESSON LXII.

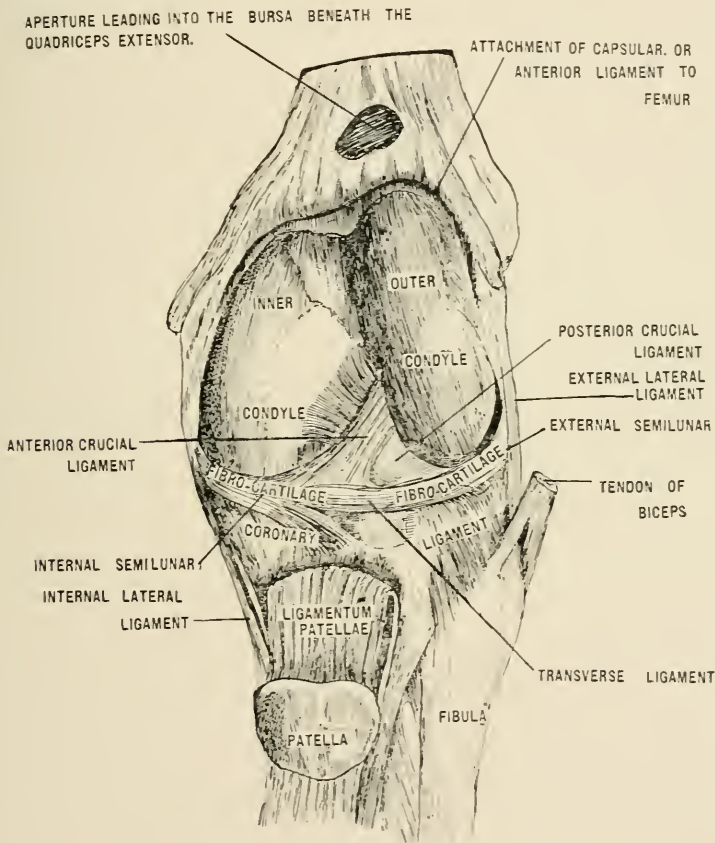
THE FASCIA OF THE LEG.

The **superficial fascia** of the leg is continuous with that of the thigh and beneath it is the **deep fascia** of the leg, which forms an investment for the muscles but is not continued over the subcutaneous surfaces of the bone. Above it joins the fascia lata and receives an expansion from the tendon of the Biceps externally and from the tendons of the Sartorius, Gracilis, Semitendinosus internally. Anteriorly it blends with the periosteum covering the subcutaneous surface of the tibia and with that covering the head and the external malleolus

of the fibula. Below it is continuous with the anterior annular ligament of the ankle. It is thin where it covers the Gastrocnemius and Soleus but thick and dense in the upper and anterior part of the leg where it gives attachment to the Tibialis anticus and Extensor longus digitorum. At the lower part of the popliteal space it is strengthened by transverse fibers and is perforated by the short saphenous vein.

The **deep fascia** of the leg gives off several small septa which enclose each muscle and externally it gives off two strong intermuscular septa which enclose

PLATE LXXXV.



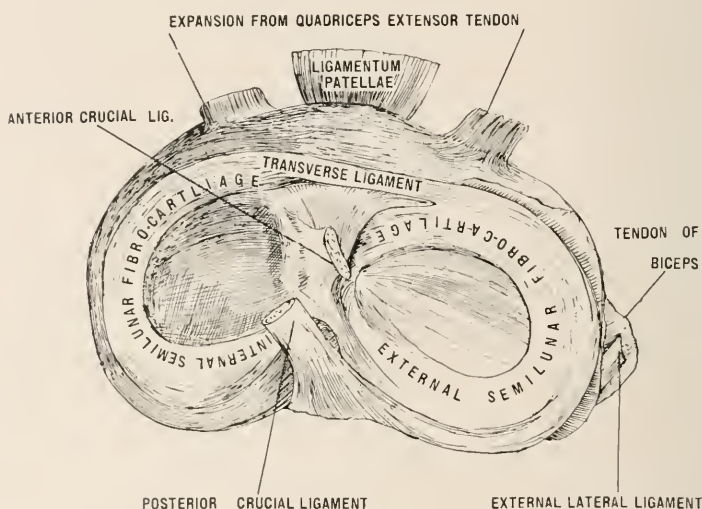
SHOWING CONDYLES AND LIGAMENTS OF KNEE-JOINT—ANTERIOR VIEW.

the peronei muscles, thus separating them from the muscles on the anterior tibial region and the muscles on the posterior tibial region. It also gives off a deep transverse fascia of the leg which passes between the superficial and deep muscles in the posterior tibio-fibular region.

The **anterior annular ligament** (Plate LXXV.) consists of two portions, a superior or a vertical portion, and an inferior or horizontal portion. The **superior portion** passes across the front of the leg between the anterior borders

of the tibia and the fibula just above the malleoli and binds down the extensor tendons as they descend on the front of the tibia and fibula. The **inferior portion** begins on the outer side of the calcaneum and divides into two layers at the outer border of the Peroneus tertius, one passing in front, the other behind and at the inner border of the Extensor longus digitorum these layers unite thus forming a canal through which these muscles pass. This inferior portion of the anterior annular ligament now divides into two branches one of which passes upward to be inserted in the front of the internal malleolus and the other passes across to be inserted on the scaphoid and internal cuneiform bones and the plantar fascia. The tendon of the Tibialis anticus has a synovial

PLATE LXXXVI.



SEMILUNAR FIBRO-CARTILAGE OF KNEE-JOINT.

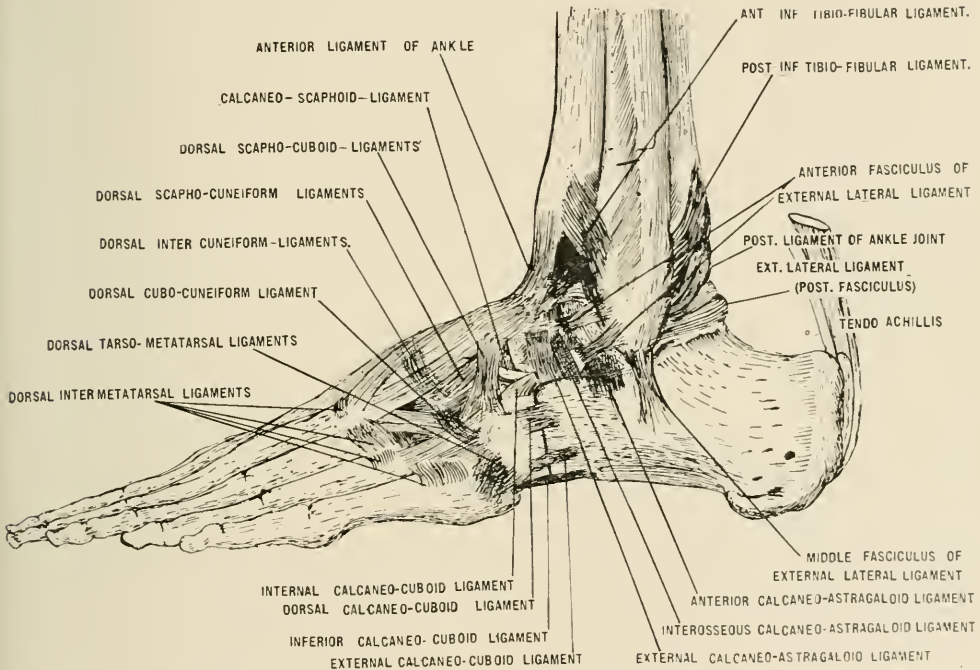
sheath in the superior portion of the anterior annular ligament and also one in the upper limb of the inferior portion, but it passes under the lower limb of the inferior portion.

The **external annular ligament** runs from the extremity of the outer malleolus to the outer side of the os calcis binding down the Peroneus longus and Peroneus brevis, which are enclosed in a single synovial membrane.

The **internal annular ligament** (Plate LXIX.) passes from the internal malleolus to the internal margin of the os calcis. It thus makes the grooves over which it passes into canals for the passage of the tendons of the flexor muscles and vessels into the sole of the foot. It joins the deep fascia of the leg above and the plantar fascia below at the origin of the Abductor hallucis. It has three canals which from within outward transmit (1) the Tibialis posticus, (2) tendon of the Flexor longus digitorum, then the posterior tibial vessels and nerve, (3) the tendon of the Flexor longus hallucis. Each of these canals is lined by synovial membrane.

The fascia on the sole of the foot is called the **plantar fascia** (Plate LV.) and is the densest of all the fibrous membranes. It is divided into three portions. (1) A **central portion** which is attached to the inner tuberosity of the os calcis and runs forward below the Flexor brevis digitorum and ends in front in a process for each toe and in slips for the skin. At its sides it joins the lateral portions which extends around the margins of the foot. At the junction of the central with the two lateral portions expansions pass upward. (2) The ex-

PLATE LXXXVII.



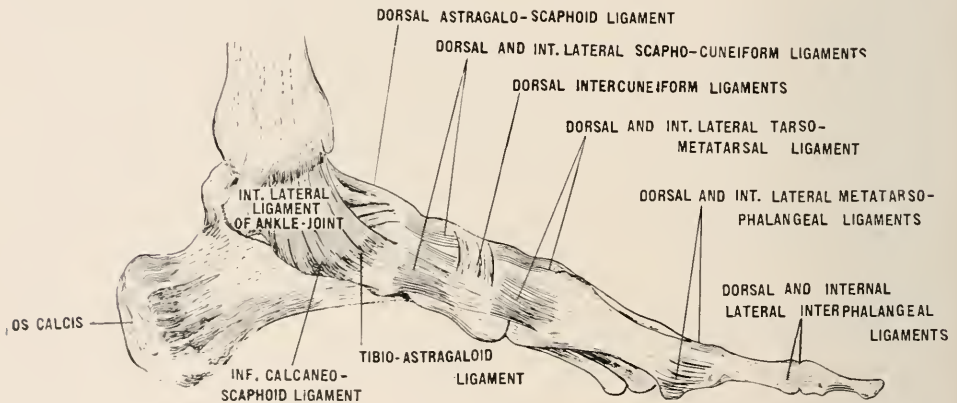
LIGAMENTS OF ANKLE—EXTERNAL VIEW.

ternal portion which is thin in front and thick behind extends from the os calcis to the base of the fifth metacarpal bone. It covers the under surface of the Abductor minimi digiti. It is continuous with the fascia on the back of the foot and with the central portion of the plantar fascia. (3) The **internal lateral portion** covers the Abductor hallucis muscle and is quite thin. Posteriorly it is attached to the internal annular ligament and continues around the side of the foot with the dorsal fascia, and externally with the middle portion of the plantar fascia.

REVIEW QUESTIONS.

1. How many muscles in the Gluteal region?
2. How many of them are attached to the great trochanter?
3. Name the muscles in the Gluteal region.
4. What nerves supplies the Gluteus maximus?
5. What nerve supplies the Gluteus minimus and medius?
6. What other muscle does this nerve supply?
7. Nerve to the Quadratus femoris comes from which ones?
8. What other muscle does it supply?
9. Nerve to Obturator internus comes from which ones?
10. What other muscle does it supply?
11. What ligaments make the greater and lesser Sacro-sciatic foramina?
12. What muscle goes through the Greater?
13. What goes through above the Piriformis muscle?

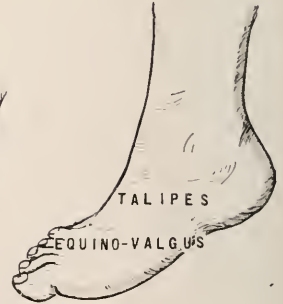
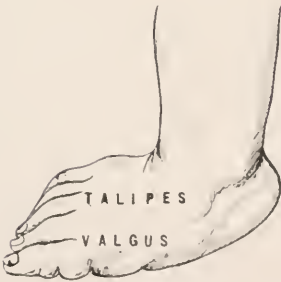
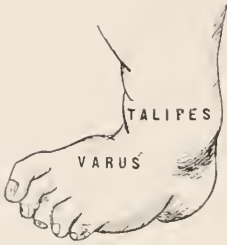
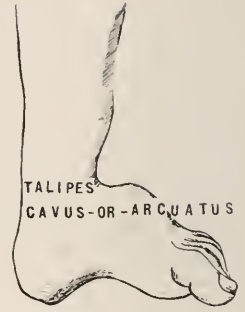
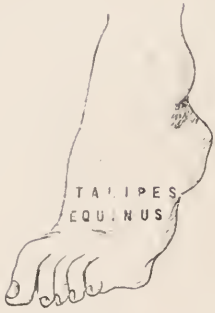
PLATE LXXXVIII.



LIGAMENTS OF ANKLE—INTERNAL VIEW.

14. What passes through below the Piriformis muscle?
15. What muscle passes through the lesser Sacro-sciatic foramen?
16. The Obturator internus is supplied from what plexus?
17. The 5th lumbar nerve belongs to what plexus?
18. The Obturator externus is supplied from what plexus?
19. How many muscles are attached to the Ischium?
20. How many muscles are attached to the Ilium?
21. How many muscles are attached to the Os Pubis?
22. How many bones in the pelvis?
23. Name them.
24. Name the divisions of the Innominate.
25. What bones form the acetabulum?
26. Name the ligaments of the hip-joint.
27. How many muscles are attached to the femur?

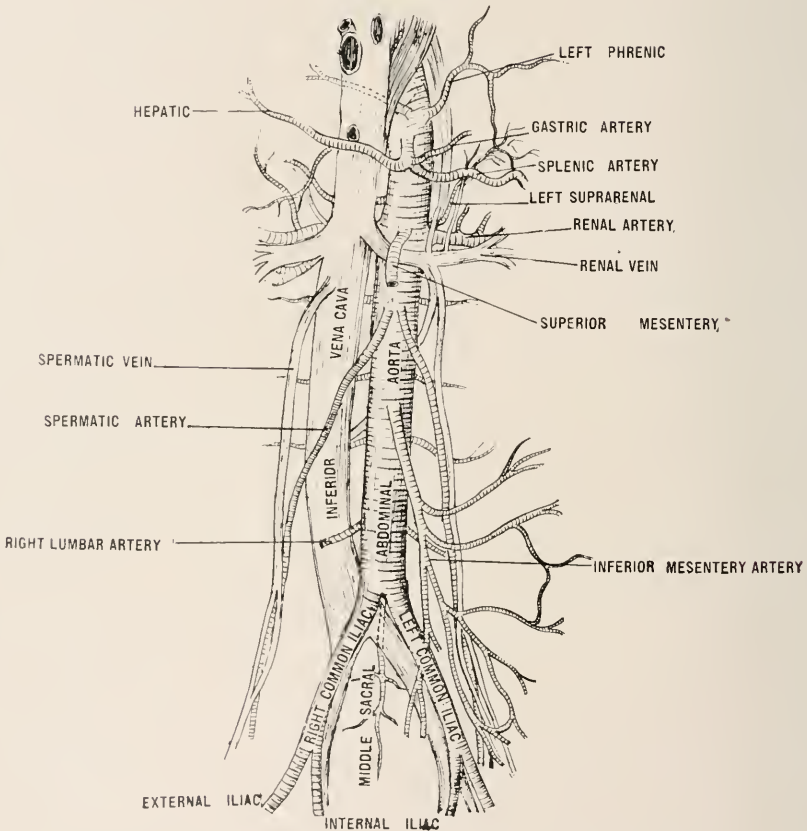
28. What nerve supplies the muscles in the anterior femoral region?
29. What nerve supplies the muscles in the internal femoral region?
30. What nerve supplies the muscles in the posterior femoral region?
31. The anterior crural and obturator nerves come from what plexus?
32. All the muscles on the posterior part of femur and from knee down are supplied by what nerve and its branches?
33. How many muscles are there from the knee to the ankle?
34. How many on the anterior tibio-fibular region?
35. How many in the outer fibular region?
36. How many in the posterior region?
37. How many layers in the posterior region?
38. What separates these two layers?
39. Name the seven muscles.
40. Name the deep layer.
41. Give nerve supply.
42. Name those in superficial layer.
43. Give nerve supply.
44. Which muscles are attached to the tibia and fibula?
45. What long bone has the insertion of only one muscle?
46. What is that muscle?
47. Name the outer hamstring.
48. Name the inner hamstring.
49. Bound Scarpa's triangle.
50. Who was Scarpa?
Italian Anatomist. 1747-1832. He was physician to Napoleon.
51. Give the floor of Scarpa's triangle from without inward.
52. What structure passes through the center of this triangle?
53. How long is the common femoral artery?
54. It gives off what branch?
55. Passes through what canal?
56. Then through what space?
57. Then gives off what branches?
58. Where does this division take place?
59. Anterior tibial passes to the front of the leg between the two heads of what muscle?
60. Anterior tibial continues below the ankle as what artery?
61. The posterior tibial artery gives off what large branch?
62. The posterior artery divides into what as it passes into the plantar surface of the foot?
63. Describe the Anterior annular ligament.
64. Describe the Internal annular ligament.
65. Describe the External annular ligament.
66. Describe the Plantar fascia.
67. Name the muscles the Great Sciatic supplies on posterior part of the leg.
68. It divides into what branches?



69. The external popliteal nerve divides into what branches?
70. The anterior tibial supplies what muscles?
71. What else does it supply besides these five muscles?
72. Musculo-cutaneous nerve supplies how many muscles?
73. Name them.
74. What else does it supply besides these muscles?
75. What nerve supplies the integument on external border of the foot?
76. From what plexus?
77. How is the short saphenous formed?
78. The internal popliteal nerve supplies how many muscles?
79. The posterior tibial supplies how many?
80. The posterior tibial divides into how many branches?
81. How many muscles does the internal plantar supply?
82. Name those it supplies in the 1st, 2nd and 3rd layers.
83. Name those supplied by the external plantar.
84. Give the cutaneous nerve supply of the foot.
85. What muscle arises just below the insertion of the Gluteus maximus?
86. The small sciatic comes from what nerves?
87. The pudic comes from what nerves?
88. The great sciatic comes from what nerves?
89. The superior gluteal comes from what nerves?
90. The inferior gluteal comes from what nerves?
91. What other nerve comes from the same?
92. What other one comes from the same one as the superior gluteal?
93. Give the relations of the common femoral artery.
94. Give the relations of the superficial femoral artery.
95. Give the relations of the profunda artery.
96. What are the divisions of the abdominal aorta?
97. The common iliac divides into what branches?
98. The internal iliac divides into what?
99. Name the branches of the anterior trunk.
100. Name the branches of the posterior trunk.
101. The external iliac continues as what?
102. What structures pass out of the Greater and into the Lesser sacro-sciatic foramen?
103. What passes through the obturator foramen?
104. What is inserted into the digital fossa?
105. Name the ligaments of the knee-joint.
106. What structures pass under Poupart's ligament?
107. Who was Poupart?
He was a Frenchman. Lived 1661-1709.
108. What structures pass through Hunter's canal?
109. Who was Hunter?
Was British. 1728-1793.
110. Bound Hunter's canal.
111. Bound the popliteal space.

112. Why called popliteal?
113. Give contents.
114. Name the ligaments of the ankle.
115. What forms the crucial anastomosis?
116. What muscles form the tendo Achillis?
117. Why is the Plantaris so called?
118. How many bones in the foot?
119. Describe the fascia lata.

PLATE XC.



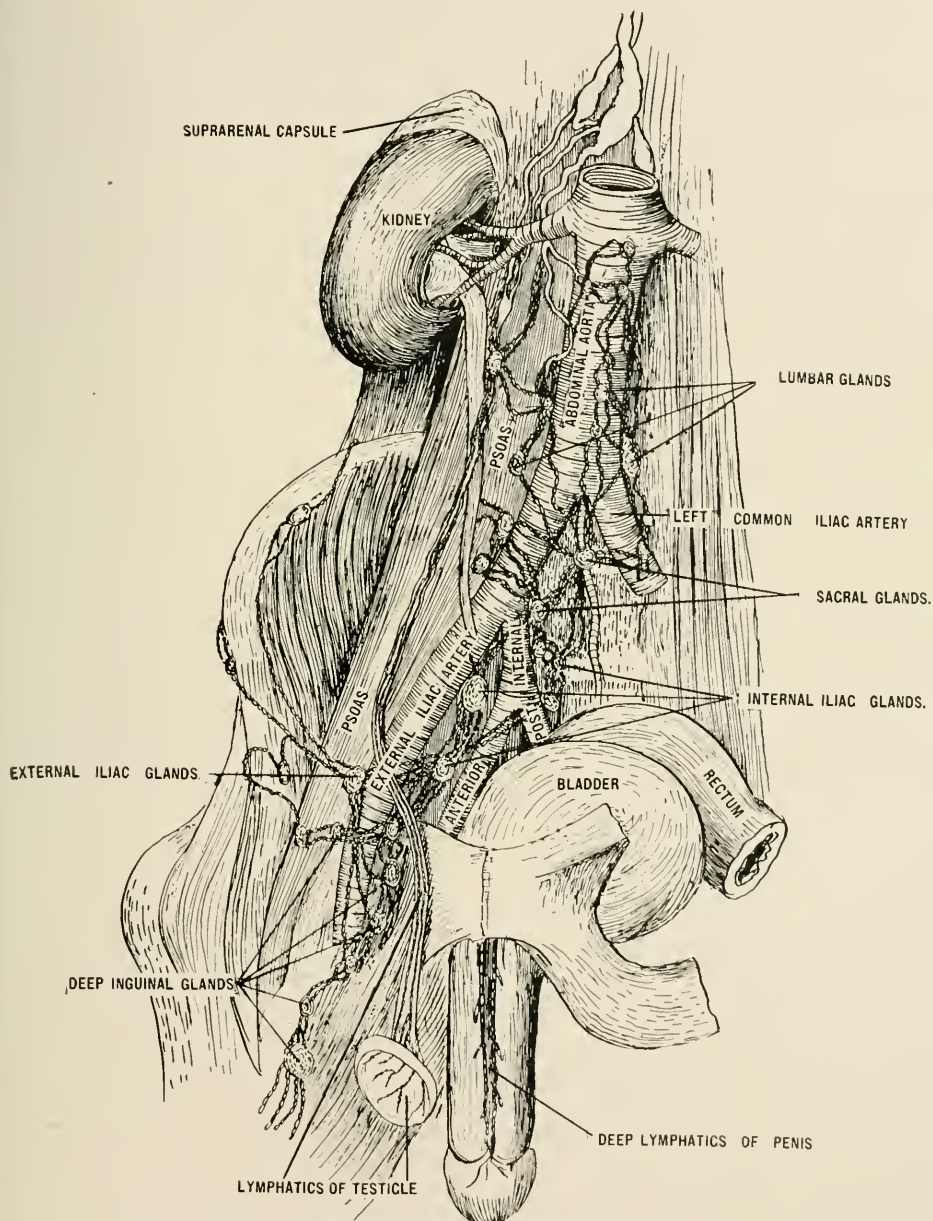
SHOWING THE GREAT VESSELS BELOW THE DIAPHRAGM.

120. Describe the deep fascia of the leg.
121. Describe the ilio-tibial band.
122. What muscles compose the Quadriceps extensor cruris?
123. The tendon of what long muscle passes directly across the sole of the foot?
124. Describe the saphenous opening.
125. Why called saphenous?
126. Describe the external abdominal ring.

127. Describe Poupart's ligament.

128. Describe Gimbernat's ligament.

PLATE XCI.



SHOWING THE ABDOMINAL AORTA AND ITS TERMINAL BRANCHES.

129. Describe Petit's triangle.

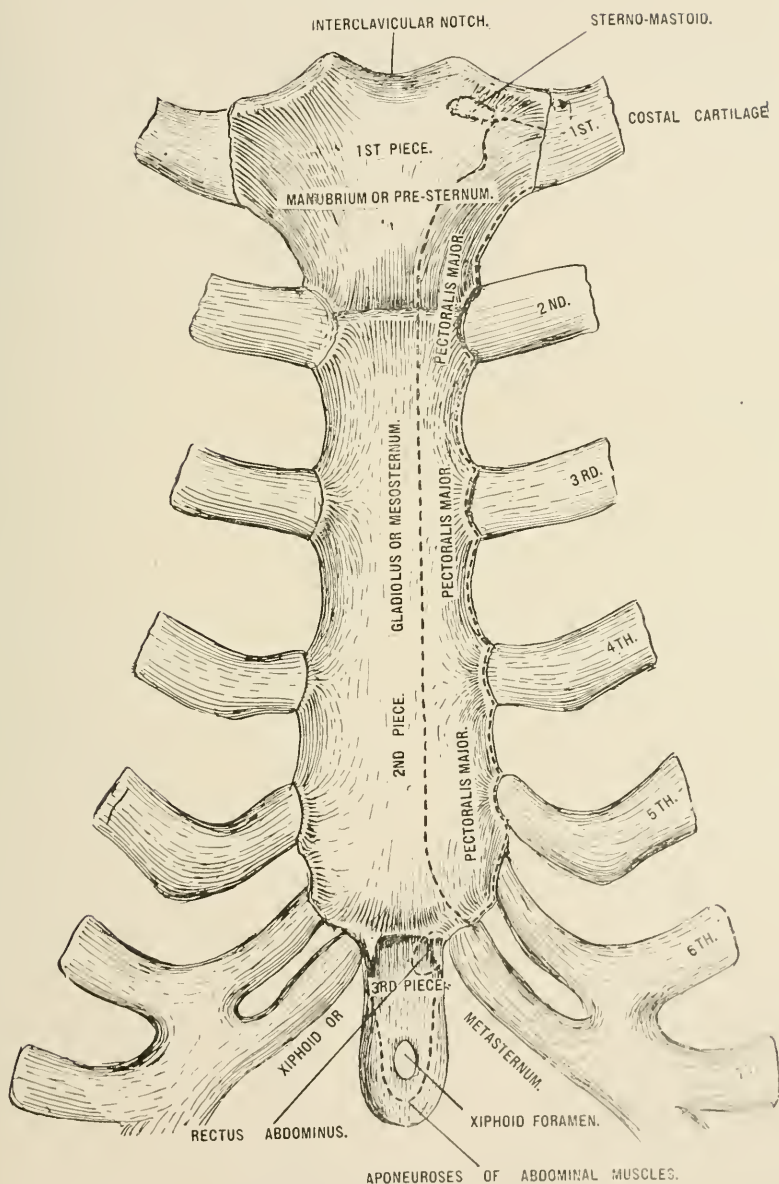
130. Describe the triangular ligament of the abdomen.

131. What muscles are attached to the intermuscular septa of fascia lata?

132. Describe internal abdominal ring.
133. What does the word hernia mean?
134. What muscles make the external rotators of hip?
135. What muscles make the internal rotators of hip?
136. Show how the external popliteal nerve gets to the front of the leg.
137. The length of the femur is what part of the length of the body?
138. Describe the linea aspera and what muscles are attached to it.
139. At what angle does the neck join with shaft of femur?
140. Give function and location of patella.
141. Describe the knee-joint.
142. What passes through the Obturator foramen?
143. Why so called?
144. Give dimensions of pelvic cavity.
145. Describe the lumbar fascia.
146. The sacral plexus continues as what?
147. Great sciatic divides into what nerves?
148. Name four kinds of hernia.
149. Name the different kind of joints found in the body.
150. Why does the arm admit of greater motion than the leg?
151. What is the sustentaculum tali?
152. What is the receptaculum chyli?
153. Where are the anterior and posterior circumflex arteries?
154. Where are the internal and external circumflex arteries?
155. What is the Biceps cubiti?
156. What muscle is attached to all tarsal bones but one?
157. Name the muscles attached to each tarsal bone.
158. Give articulation of each tarsal bone.
159. Name the spinous processes of the ilium.
160. What is attached to each?
161. Give meaning of trochanter.
162. Give blood supply, ossification, articulation and attachment of muscles to the os innominatum.
163. Same for femur.
164. Same for tibia.
165. Same for fibula.
166. Same for tarsus.
167. Same for metatarsus.
168. Same for phalanges.
169. Same for patella.
170. Same for sacrum.
171. Same for coccyx.
172. Give branches of femoral artery.
173. Give branches of popliteal artery.
174. Give branches of anterior tibial artery.
175. Give branches of posterior tibial.
176. Give branches of dorsalis pedis.

177. Give branches of peroneal artery.
 178. Give plantar arch.
 179. This arch gives off what branches?

PLATE XCII.



ANTERIOR VIEW OF STERNUM.

180. Which is the larger—external or internal plantar artery?
 181. Which is the larger—the external or internal plantar nerve?
 182. Give relation of popliteal artery.

- 183. Give relation of anterior tibial artery.
- 184. Give relation of posterior tibial artery.
- 185. Give relation of peroneal artery.
- 186. Give relations of dorsalis pedis artery.

LESSON LXIII.

THE THORAX. (Plate XCIV.)

The **thorax** is formed by thirty-seven bones, namely, the twenty-four ribs the twelve dorsal vertebræ, and the sternum. The thorax is a conical cavity, broad below, narrow above, flattened from before backward, and longest posteriorly. Its posterior boundary is formed by the bodies of the dorsal vertebræ and the posterior portion of the ribs, thus making it concave vertically with a high ridges on either side. The lateral boundaries are convex, being formed by the ribs and Intercostal muscles. The anterior boundary, which slopes down and forward, is formed by the sternum and the costal cartilages.

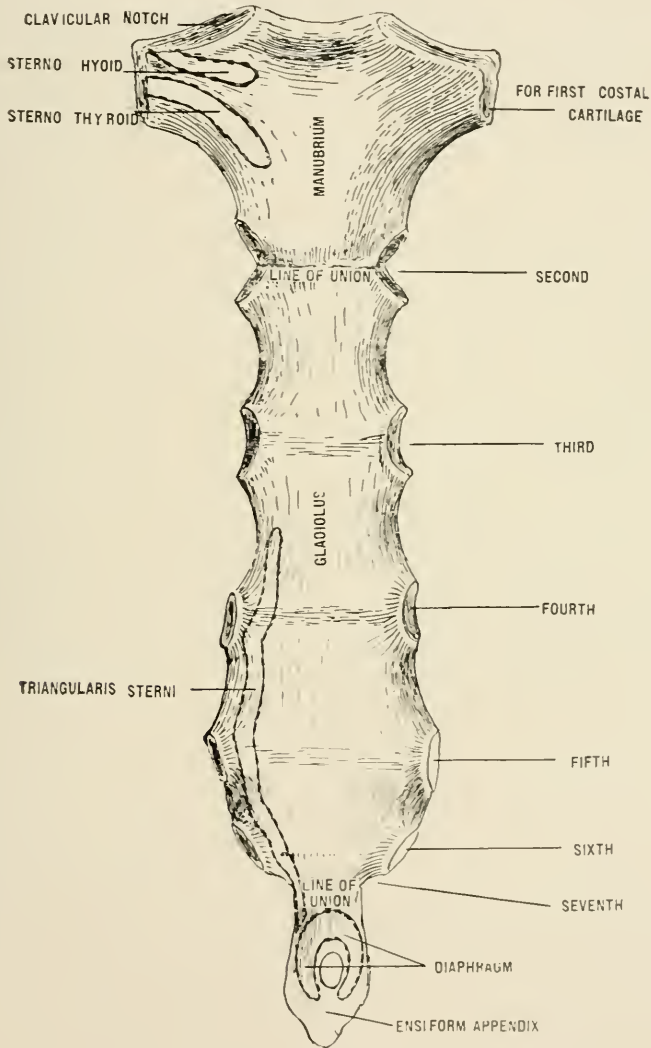
The **upper opening** of the thorax is broadest transversely and is formed by the first dorsal vertebra posteriorly, first ribs laterally, and the upper margin of the manubrium anteriorly. The upper border of the manubrium is on a level with the second dorsal vertebra. In the female the sternum is shorter than in the male, the ribs more movable, and the thorax is smaller. The upper margin of the manubrium is on a lower level than in the male. There are **forty structures** passing through the superior opening of the thorax. There are **three pairs of muscles** that pass through this upper opening in the thorax. Sterno-thyroid, Sterno-hyoid and Longus colli muscles, making six muscles. The **arteries** that pass through the superior opening of the thorax are the (1) innominate, (2) left common carotid and (3) left subclavian, (4) and (5) the two internal mammary and (6) and (7) the two superior intercostal. There are **fifteen nerves** that pass through this opening: (1) and (2) the two Pneumogastric, (3) and (4) the two phrenic, the six cardiac and the two sympathetic nerves, the anterior branches of the two first dorsal nerves, and the recurrent laryngeal nerve of the left side make fifteen. The **veins** that pass through this superior opening are the right and left innominate and the inferior thyroid veins, making four veins. There are eight **unclassified structures** that pass through this opening in the thorax: Remains of thymus gland, trachea, œsophagus, thoracic duct, apex of each lung, and pleuræ. Then the six muscles, fifteen nerves, seven arteries, four veins, and eight unclassified structures make the forty structures which pass through the superior opening of the thorax.

The **lower opening** of the thorax is widest transversely and slopes downward and backward. It is formed by the last dorsal vertebra posteriorly, and the seventh to the eleventh costal cartilages laterally, and the ensiform cartilage anteriorly. The Diaphragm separates the thoracic cavity from the abdominal cavity.

DIAPHRAGM. (Plate LXXII.)

The word **diaphragm** is a Greek word meaning a partition wall. It is a musculo-fibrous septum, situated between the upper one-third and the lower two-thirds of the trunk. It separates the thoracic cavity from the abdominal cavity. It is the floor of the former and the roof of the latter, its general shape

PLATE XCIII.



POSTERIOR VIEW OF STERNUM.

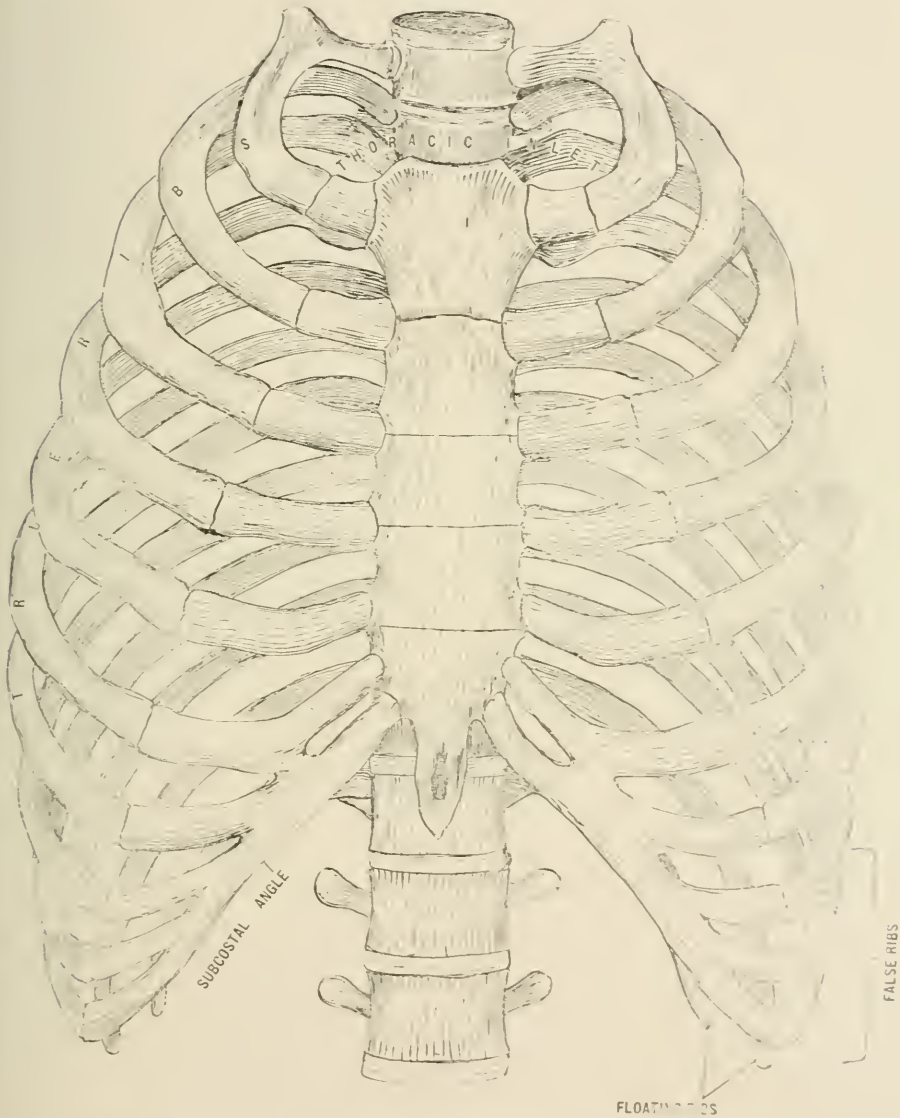
is somewhat like that of an umbrella or an irregular dome. The **upper surface** of it is covered with the right and left pleura, between the two pleura it is covered with the pericardium. Its circumference is elliptical in form, highest at the ensiform cartilage. The **highest part** of all the diaphragm is on the right side

immediately above the liver. This is a little higher than the left side. The **lowest part** of it is the right crus which reaches to the fourth lumbar vertebra. The **under surface** is covered with peritoncum. It is one of the so-called double bellied muscles. It has its **origin** in front from the ensiform cartilage, from the sides, from the under surfaces of the cartilages and bony portion of the six or seven lower ribs interdigitating with the Transversalis muscle, also from the two aponeurotic arches called the ligamentum arcuatum externum et internum. The last one is the covering of the Psoas magnus, the first one is the covering of the Quadratus lumborum. Behind it is connected to the spine by two crura or legs, the right one is the longer extending from the anterior surface of the bodies and intervertebral substance of the three or four upper lumbar vertebræ; the left one from the anterior surfaces of the two upper ones. From this origin it passes to the central or cordiform tendon which consists of **three leaflets**, the right one is the largest, the left one the smallest, and the middle one is intermediate in size. On each side of the ensiform attachment there is a weak place which may be broken; then we may have what is called a **phrenic or diaphragmatic hernia**. Some of the contents of the abdomen protrude into the chest, or pus in the mediastinum may descend through it into the abdominal cavity. The diaphragm has **three large and several small natural foramina**. The one most posterior is really not in the diaphragm but between the two crura which are joined posteriorly by a tendinous band. This is called the **aortic opening**, and transmits the aorta, vena azygos major, the thoracic duct, and sometimes the left sympathetic nerve; when this nerve does not pass through this opening it goes through the left crus. The vena azygos major occasionally goes through the right crus. The **second large opening** is in front, and a little to the left of the aortic opening; it transmits the œsophagus and the pneumogastric nerves. The left pneumogastric passes in front of the œsophagus. The right one, which passes behind it, goes into the solar plexus, which is situated behind the stomach. The **third large opening** is farther in front than the others and lies in the central tendon. It is somewhat quadrilateral in form and is called the foramen quadratum; the inferior vena cava passes through it.

The **smaller openings** are through the crura. Those in the right crus transmit the greater and lesser splanchnics and the sympathetic nerves of the right side, occasionally the vena azygos major. The left crus transmit the vena azygos minor, the greater or lesser splanchnic nerves of the left side and the sympathetic nerve of the left side when it does not pass through the aortic opening. The **blood supply** of the diaphragm is derived from the two phrenic, the internal mammary, and the lower intercostal arteries. The phrenic arteries are two small arteries which may arise separately from the aorta above the coeliac axis. Often one is derived from the aorta and the other from the renal arteries. They very rarely arise as two separate vessels from the aorta. The nerve supply is the phrenic which comes from the third, fourth, and fifth cervical nerves. The phrenic plexus also helps to supply it. This plexus is made by the phrenic nerve and branches from the semilunar ganglion of the solar plexus. The laity call the diaphragm the **midriff**, which comes from the Saxon words which mean the middle of the belly. The solar plexus or abdominal brain and the

phrenic plexus are situated near the diaphragm. The former behind the stomach and the latter formed by branches from it. These plexus or plexuses belong to the great sympathetic system, which governs the involuntary actions.

PLATE XCIV.



BONES OF THE THORAX.

A severe blow on the head may knock a man senseless but he still lives. His heart and lungs still act, being governed by the sympathetic system, but if he receives a severe blow upon the diaphragm it may produce instant death. The pugilist has learned this much about anatomy and if he were not trained to the

hour more would be killed than are by this so-called solar plexus blow. The diaphragm is the chief muscle of respiration. The lower ribs may fall down thus drawing the diaphragm out of its natural position, in this way somewhat obstructing the passing of the blood through the aorta. I have known of one case in which the diaphragm was pulled down by the lower ribs causing an irregular action of the heart. As soon as they were replaced the heart acted in a natural manner. Tight lacing, or any cause whatsoever which will impair the natural action of the diaphragm will cause much pain. Man is the only animal in which the transverse diameter of the diaphragm is greater than the antero-posterior. It begins to be developed about the ninth week of fetal life and grows from the circumference to the central tendon. All mammals or milk-giving animals have a diaphragm. Man and horse are examples of land animals, the whale and the sea cow are examples of water animals which have diaphragms. Birds possess a rudimentary form, which is best shown in the abteryx.

LESSON LXIV.

The muscles which help the Diaphragm in **tranquil inspiration** are (1) Intercostals, (2) Levatores costarum, and (3) The Scaleni. Those which help it in **forced inspiration** are (1) Trapezius, (2) Pectoralis minor, (3) Pectoralis major (?) (4) Serratus posticus superior, (5) Serratus posticus inferior, (6) Rhomboideus major, (7) Rhomboideus minor, (8) Serratus magnus, (9) Sterno-cleido-mastoid, (10) Ilio-costalis, (11) Quadratus lumborum.

Tranquil expiration is caused by the elasticity of the lungs and that of the chest walls. The muscles of **forced expiration** are (1) External oblique, (2) Internal oblique, (3) Transversalis, (4) Rectus abdominis, (5) Internal intercostals, (6) Triangularis sterni.

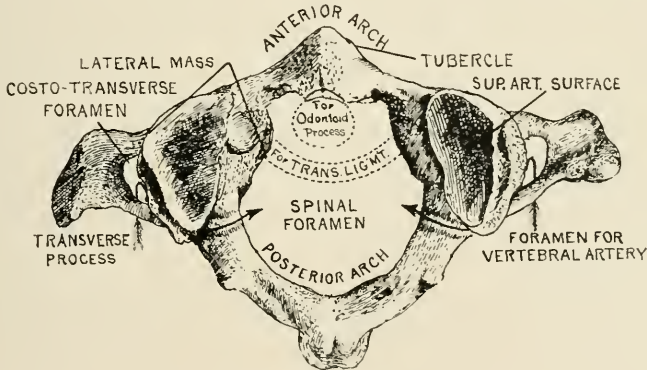
The **sternum** (Plates XCH-XCIII.) is about six inches long and is situated in the median line of the thorax in front. It is flat anteriorly and concave posteriorly. It is broadest above and pointed below, and constricted at the junction of the manubrium with the gladiolus. The **manubrium** or **first piece** of the sternum is narrow below, but broad above. The anterior surface of the manubrium is concave vertically but convex transversely. The Pectoralis major and Sterno-cleido-mastoid are attached to the lateral aspect of this surface. The upper border of this part forms the interclavicular notch, on each side of which is an oval facet for the articulation of the clavicle. The lateral border articulates above with the cartilage of the first rib and below with the upper portion of the cartilage of the second rib. The lower border articulates with the gladiolus. The posterior surface is concave and gives attachment to the Sterno-hyoid and Sterno-thyroid muscles. The **gladiolus** or **second portion** is longer, narrower and thinner than the manubrium. It is broadest below. The anterior surface gives attachment to the Pectoralis major. Three transverse lines, indicating the original divisions of the gladiolus into four portions, pass from the third, fourth, and fifth articular facets across the bone. These lines are not so well marked on the posterior surface. This surface is concave

and gives attachment to the *Triangularis sterni* muscle. The lateral border of the gladiolus articulates with the cartilages of the second, third, fourth, fifth, sixth, and seventh rib; however the second and seventh cartilages articulate partly with the bones above and below. This portion of the bone articulates with the manubrium above and the ensiform or xiphoid appendix below.

The **ensiform appendix**, cartilaginous in youth but is partly ossified above in the adult. The chondro-xiphoid ligament is attached to its anterior surface, while the Diaphragm and the *Triangularis sterni* are attached to its posterior surface. It articulates above with the gladiolus. Laterally the aponeurosis of the abdominal muscles are attached. The superior angle of the lateral border has a demi-facet for the cartilage of the seventh rib. Its apex may be bifid below or may present a foramen, and it gives attachment to the *linea alba*.

ATTACHMENT OF MUSCLES:—Nine pairs and one single muscle. The *Pectoralis major*, *Sterno-cleido-mastoid*, *Sterno-hyoid*, *Sterno-thyroid*, *Tri-*

PLATE XCV.



THE ATLAS

angularis sterni, aponeurosis of the *External oblique*, *Internal oblique*, *Transversalis*, *Rectus* muscles, and *Diaphragm*.

OSSIFICATION:—From six centers. One for the manubrium (FIFTH OR SIXTH MONTH.) One for each of the four pieces of the gladiolus. The ones for the first two pieces of the gladiolus appear at the SIXTH OR SEVENTH MONTH. The one for the third piece appears at the NINTH MONTH, and the one for the fourth piece appears during the FIRST YEAR AFTER BIRTH. The one for the ensiform appendix appears between the SECOND AND EIGHTEENTH YEARS. The manubrium and the lower three pieces of the gladiolus may have two centers each, thus making ten centers of ossification for the sternum. The pieces of the gladiolus join at about the age of puberty, while the gladiolus rarely joins the manubrium and the ensiform remains cartilaginous even in advance life.

ARTICULATION.—With the clavicles and seven costal cartilages on each side.

BLOOD SUPPLY.—Internal mammary arteries through its sternal and perforating branches, also twigs from the aortic intercostal arteries.

HEART.

The **covering of the heart** is called the Pericardium. Besides covering the heart it encloses the origin of the great vessels. It is situated behind the sternum from the third to the seventh costal cartilages (inclusive) and between the two pleuræ. It forms a closed sac, the **base** of which is attached to the central tendon and adjoining muscular substance of the Diaphragm, and it extends more to the left than to the right. The **apex** of the pericardium is directed upward and surrounds the great vessels for about two inches. Behind the pericardium are (1) the two bronchi, (2) the œsophagus, (3) descending aorta. In front are (1) the margin of the lungs, (2) remains of the thymus gland (above), (3) areolar tissue (below), (4) the sternum. On the sides it is covered by the pleura and the phrenic nerve.

The **pericardium** is composed of two layers, first a fibrous, second a serous. THE **FIBROUS OR EXTERNAL LAYER** is strong and dense. It sends prolongations around the great vessels which join their external coats. It also sends a diverticulum upward on each side of the ascending aorta. The one on the left side of the ascending aorta passes between the left pulmonary artery and the arch of the aorta to the ductus arteriosus where it ends in a blind extremity. The one on the right side of the ascending aorta passes between this vessel and the superior vena cava, and it also ends in a blind extremity. This fibrous layer is attached below to the central tendon and muscular substance of the Diaphragm. Two ligaments, the **superior sterno-pericardial** and the **inferior sterno-pericardial**, connect it with the sternum anteriorly.

THE **SEROUS OR INTERNAL LAYER** consists of two portions, first a visceral, and second a parital. The visceral layer covers the heart and the great vessels for about an inch and a half and then is reflected upon the inner surface of the fibrous layer forming the parietal portion. The pulmonary artery and the aorta are enclosed in a single tube of pericardium. Behind this tube there is a passage called the transverse pericardial sinus. The pericardium only partially covers the vena cava and pulmonary veins, so that on each side of these structures there is a cul-de-sac. The one on the left side is known as the oblique sinus, the one on the right as the straight sinus. The **vestigial fold of Marshall** lies between the left pulmonary artery and the subadjacent pulmonary vein, thus enclosing the remains of the left superior vena cava. This left superior vena cava is a fibrous cord which may be traced upward to the left superior intercostal vein and downward to the coronary sinus and known as the oblique vein of Marshall.

BLOOD SUPPLY.—The arteries to the pericardium come from the descending thoracic aorta and the internal mammary with its musculo-phrenic branch.

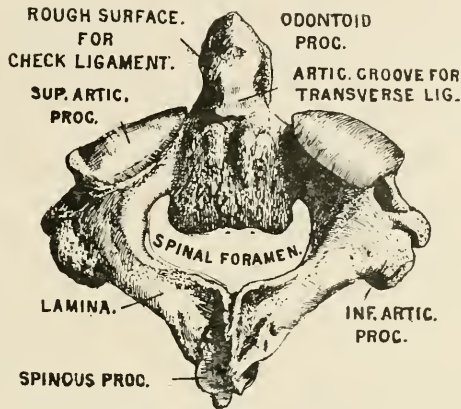
NERVE SUPPLY.—Nerves to the pericardium are from the tenth, phrenic, and sympathetic. The nerve supply to the pericardium, the heart, the pleuræ, and the lungs, is derived from these three sources. As said above they all go to the pericardium. The tenth, the sympathetic and possibly the phrenic pass

to the heart. The tenth and sympathetic go to the lungs substance, while the phrenic and sympathetic pass to the pleura.

LESSON LXV.

The **heart** (Plate CXXVIII.) is situated in the middle mediastinum between the spinous processes of the fourth dorsal and eighth dorsal vertebrae posteriorly. Its apex is directed downward and forward to the left, and lies against the fifth intercostal space three-quarters of an inch to the inner side of

PLATE XCVI.



POSTERIOR VIEW OF AXIS.

the left nipple and an inch and a half below the same. The heart lies obliquely behind the lower two-thirds of the sternum, extending about three inches to the left of the median line and one and a half inches to the right. Its anterior surface consists mostly of the right ventricle and a part of the left ventricle. It is convex and looks upward and forward. Its posterior surface consists mostly of the left ventricle and rests upon the Diaphragm. This surface is flattened. The right border of the heart is long and thin, while the left is short and thick.

The **average weight** of the heart is about eleven ounces. In the male it weighs from ten to twelve ounces, while in the female its weight is from eight to ten. The adult heart is five inches long by three and a half wide, by two and a half thick. It is divided into four chambers, namely, the right and left auricles and the right and left ventricles. The right side of the heart, which is more superficial and is called the venous heart, is separated from the left side of the heart, which is deeper and is called the arterial heart, by a longitudinal septum, and each of these lateral halves are divided by a transverse septum, thus making the auricles and ventricles.

These **four divisions** of the heart are indicated by grooves on its surface. The apex of the heart is formed entirely by the left ventricle. These grooves on the surface of the heart contain the coronary arteries, cardiac veins, lymphatics, nerves and fat.

The **right auricle** has a capacity of about two ounces. It is larger than the left auricle but its walls are thinner. It consists of two main parts, first a **sinus** or **atrium** which is large and lies between the superior vena cava above and the inferior vena cava below and has postero-internally to it the left auricle. The second part is the **auricular appendix**, which is small and conical projecting forward and to the left over the root of the aorta. The inner surface of the auricle is smooth except in this auricular appendix and the adjacent part of the right wall of the sinus. At this point it is thrown into parallel ridges called *musculi pectinati*. (Plate CXXIX.)

The **right auricle** has the following points for consideration:

1. The **opening of the superior vena cava**, which is at the upper and back part of the auricle and is directed downward and forward. The blood from the superior vena cava flows toward the auriculo-ventricular opening.

2. The **opening of the inferior vena cava** is larger than the superior and is at the lower part of the auricle near the auricular septum. The blood from the inferior vena cava is directed upward and inward towards the auricular septum.

3. There is small projection between the superior vena cava and the inferior vena cava called the **tubercle of Lower**. Its function is to direct the blood from the superior vena cava towards the auriculo-ventricular opening.

4. There is an opening between the inferior vena cava and the auriculo-ventricular opening called the **coronary sinus**. It is guarded by a valve called coronary or Thebesii. It receives blood from the substance of the heart and it is constricted where it joins the great coronary vein.

5. The **auriculo-ventricular opening** is somewhat oval and about an inch in diameter and lies between the right auricle and right ventricle. It is surrounded by a fibrous ring covered by the lining membrane and is guarded by the Tricuspid valve.

6. The **foramina of Thebesii** are small openings of the *venæ cordis minimæ* which return blood from the substance of the heart.

7. A semilunar fold of the endocardium which lies between the auriculo-ventricular opening and the anterior margin of the opening of the inferior vena cava is called the **Eustachian valve**. In the fetus this valve is large and directs the blood from the inferior vena cava through the foramen ovale into the left auricle. It may be present or it may be absent in the adult.

8. The **coronary valve** also called **Thebesii** is a semicircular fold of endocardium which guards the opening of the coronary sinus. This valve may be double and it prevents regurgitation into it during systole of the auricle.

9. The **fossa ovalis** is a remains of fetal life. It is an oval depression lying on the lower part of the auricular septum marking the position of the foramen ovale. There may be a small foramen in this fossa throughout life.

10. The **annulus ovalis** is a prominent margin of the foramen ovale and is best marked above and at the sides, while below it is wanting.

11. The **musculi pectinati** are small muscular folds which are found in the auricular appendix and the adjacent part of the sinus venosum. They end in a vertical ridge posteriorly called the *crista terminalis* of His.

The **right ventricle** extends from the right auricle nearly to the apex of the

heart. Its walls are one-third as thick as those of the left ventricle, and it holds about three ounces. Its posterior surface rests upon the Diaphragm forming a small part of the back of the heart, while its anterior surface forms most of the front of the heart.

1. The **conus arteriosus** or **infundibulum** is a conical pouch at the upper and left angle of the ventricle, from which the pulmonary artery arises.

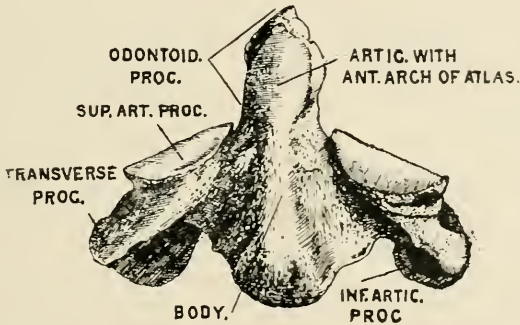
2. The **auriculo-ventricular opening** has been described with the auricle.

3. The **opening of the pulmonary artery** which lies at the summit of the infundibulum is circular. It is guarded by the pulmonary semilunar valves.

4. The **tricuspid valve** consists of three portions. The largest of these segments, called the left or infundibular flap, lies at the left and front of the opening. The right flap is to the front and right, while the third, called the posterior or septal flap, is posteriorly. The center of each of these flaps is thick, the lateral margins are thin.

5. The **chordæ tendinæ** are fibrous cords which are attached to the mar-

PLATE XCVII.



ANTERIOR VIEW OF AXIS.

gins and ventricular surfaces of each of these flaps. Three or four are attached to the bases of each flap and are continuous with the fibrous ring which surrounds the auriculo-ventricular opening. Four to six pass to the central part of these flaps, and the finest and most numerous go to the free margins of these flaps.

6. **Columnæ carneæ** project from the walls of the ventricle except near the pulmonary opening. They are divided into three sets, the first set are attached throughout their length thus forming mere ridges. The second set called trabeculæ, are attached to their ends only, thus forming arches, while the third set, called muscoli papillares, are attached to one end only, thus forming pillars. These muscoli papillares are two in number, an anterior and a posterior, and they give attachment by their free ends to the chordæ tendinæ. Those from the anterior one pass to the right and left flaps, while those from the posterior one pass to the right and septal flaps. A few of the chordæ tendinæ pass to the left and septal flaps from the septum.

7. The **semilunar valves** (Plate XCXXX.) (pulmonary) are three in number. Two anterior, (a right and left), and one posterior. They are formed by

folds of fibrous membrane, covered by endocardium below and by the inner arterial coat above. The convex margin of each valve is attached to the inner coat of the artery where it joins the ventricle, while its double crescentic border is free and is directed upward. The **corpus arantii** are small nodules situated at the center of each free margin. Tendinous fibers radiate from the corpus arantii to the attached margin of the valve, passing throughout the entire valve excepting a small portion on each side of the corpus arantii called the **lunula**. At this point the valve consists of lining membrane only. When the valve closes the surfaces of the lunula come in contact and the copora arantii fill the interval at the center. **Sinus of valsalva** is a pouch behind each valve.

8. The **moderator band** is a muscular beam running across the left ventricle obliquely.

LESSON LXVI.

The **left auricle** like the right auricle has two parts, a **sinus** or **atrium** and an auricular appendix. This auricle is smaller but has thicker walls than the right one. The atrium lies behind the aorta and the pulmonary artery and is separated from the right auricle by the auricular septum internally. The left auricular appendix is longer and narrower, and more curved than the right one, and it projects forward to the right over the root of the pulmonary artery.

The **left auricle** presents the following points:

1. The **openings of the four pulmonary veins**, two on each side. These veins have no valves and carry pure blood. There may be five pulmonary veins or only three.

2. The **auriculo-ventricular opening** is smaller than the one on the right side. It is surrounded by a fibrous ring covered by endocardium and guarded by the mitral valve.

3. The **musculi pectinati** are fewer and smaller than those on the right side and are confined to the auricular appendix.

4. On the auricular septum, just above the fossa ovalis of the right auricle, there is an **impression** which is bounded below by a crescentic ridge whose concavity looks upward.

The **left ventricle** is longer than the right and its walls are about three times as thick. It forms most of the posterior surface of the heart, all the apex, and a small part of the left side of the anterior surface.

The **left ventricle** presents the following points:

1. The **auriculo-ventricular opening** which is below and to the left of the aortic opening is described with the left auricle.

2. The **aortic opening** is circular and is guarded by the semilunar valves. It is situated in front and to the right of the auriculo-ventricular opening.

3. The **mitral** or **bicuspid valve** is attached to the margin of the auriculo-ventricular opening similar to the tricuspid valve on the right side of the heart, but is stronger and thicker than the tricuspid valve. Its segments or flaps are covered by endocardium and contain a few muscle fibers. The larger flap lies to the right and in front between the auriculo-ventricular opening and the

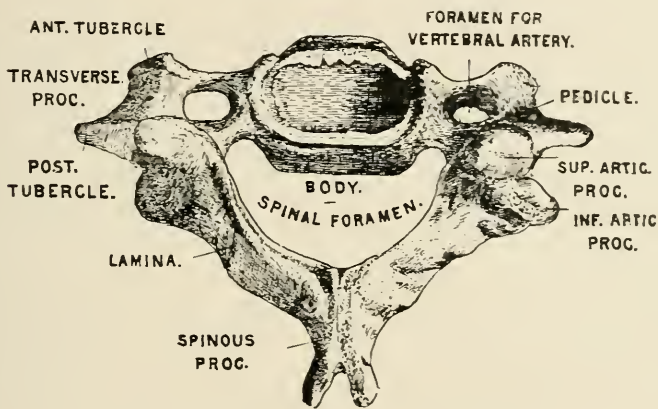
aortic opening. The smaller flap lies to the left and behind. The smaller flaps are usually found where the two larger flaps meet.

4. The **chordæ tendinæ** are thicker, stronger, and less numerous, but have a similar attachment as those on the right side

5. The **semilunar valves** (aortic) are three in number, a right posterior, a left posterior, and an anterior one. They are larger, thicker, and stronger than those on the right side, but are similar in structure and attachment. Their corpora arantii and lunula are more distinct than those of the pulmonary semilunar valves. Their sinuses of valsalva are larger than those on the right side. The right coronary artery arises from the anterior sinus and the left coronary artery arises from the left posterior sinus.

6. The **columnæ carneæ** are smaller and more numerous than those on the

PLATE XCVIII.



THE FIFTH CERVICAL VERTEBRA.

right side and are arranged in a similar manner. On the posterior wall and at the apex they are interlaced. The **musculi papillares** are larger than those on the right side, one of which comes from the anterior wall, the other from the posterior wall. The **chordæ tendinæ** arise from their free ends.

7. Just under the aortic opening there is a small cavity called the **aortic vestibule**.

8. The **ventricular septum** is thick below but above it becomes thinner and losing its muscular fibers consists only of fibrous tissue covered by endothelium.

For position of valves of the heart in reference to the chest wall, see Plate XVII.

The **structures of the heart** consists of muscular fibers and fibrous rings. The muscular structure called **myocardium** is formed from small striated, and quadrangular muscular cells which have nuclei joined end to end to form fibers and tend to branch, anastomosing with other cells. Some say the heart is a voluntary muscle because it has striated fibers, but it is governed by the sympathetic nerve thus making it involuntary in action.

The **fibrous rings** are stronger on the left side than on the right. They

surround the auriculo-ventricular openings and the arterial openings, giving attachment to the muscle fibers, valves, and great vessels.

The **endocardium** is a smooth, thin membrane which lines the heart and is more opaque on the left side and is thickest in the auricles, being thicker in the left auricle than in the right.

BLOOD SUPPLY.—The arteries are the right and left coronary. The **right coronary artery** arises from the anterior sinus of valsalva and passes forward between the pulmonary artery and the auricular appendix. From this point it runs in the right auriculo-ventricular groove to the posterior interventricular groove, and here it divides into a transverse branch which runs in the left auriculo-ventricular groove and a descending branch which runs in the posterior interventricular groove to the apex of the heart. A marginal branch which comes from this artery runs along the margin of the right ventricle. It also gives infundibular branches to the right auricle and right ventricle and the pulmonary artery. (Plate CXXVIII.)

The **left coronary artery**, which is larger than the right, arises from the left posterior sinus of valsalva and passes forward between the pulmonary artery and the left auricular appendix. At this point it divides into a transverse branch, which runs outward in the left auriculo-ventricular groove and a descending branch which runs to the apex of the heart in the anterior interventricular groove. The coronary arteries may come from a common trunk and there may be one or two small additional branches. (Plate CXXVII.)

The **cardiac veins** return the blood from the substance of the heart into the right auricle.

1. The **anterior cardiac vein**, also called great cardiac vein, ascends from the apex of the heart to the base of the ventricle in the anterior interventricular groove. It turns to the left into the left auriculo-ventricular groove and opens at the back of the heart into the great coronary sinus where it has two valves. It drains both ventricles (more the left than the right), and the left auricle.

2. The **middle cardiac vein** ends in the great coronary sinus after running from the apex of the heart to its base in the posterior interventricular groove.

It has one valve at its orifice and it drains the posterior part of both ventricles.

3. The posterior surface of the left ventricle is drained by the **left or posterior cardiac veins** which empty into the great coronary sinus.

4. The **right or anterior cardiac veins** receive the blood from the anterior surface of the right ventricle and open separately into the lower part of the right auricle. The largest one of these veins, which runs along the right border of the heart, is called the vein of Galen.

5. The **right or small coronary sinus** drains the back part of the right auricle and right ventricle and it runs in the right auriculo-ventricular groove and ends in the right end of the great coronary sinus.

6. The **left or great coronary sinus** is then a portion of the great cardiac vein which is about an inch long and occupies the posterior part of the left auriculo-ventricular groove. It receives the veins just mentioned and also an

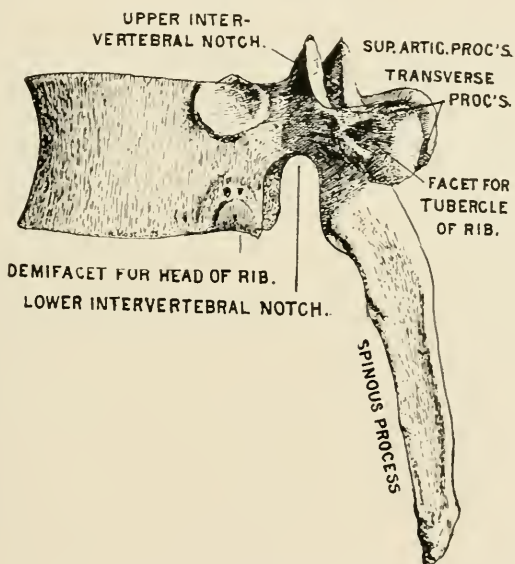
oblique vein from the back of the left auricle which is the remnant of the obliterated left vena cava called duct of Cuvier. This great coronary sinus ends in the right auricle between the inferior vena cava and the auriculo-ventricular opening. The opening of this sinus is guarded by a semilunar fold of the lining membrane of the heart called the coronary valve or Thebesii.

7. **Venæ Thebesii** are minute veins which drain the cardiac muscular substance and open directly into the right auricle by the foramina of Thebesii.

LESSON LXVII.

NERVE SUPPLY.—The nerves to the heart are derived from the cardiac plexuses, formed by the pneumogastric and sympathetic nerves. Its actions are involuntary. The nerves of the heart are derived from three sources:

PLATE XCIX.



A DORSAL VERTEBRA, WITH LONG SPINE.

1. From nerve cells buried in its own substance and known as the intrinsic ganglia.

2. From the tenth pair (pneumogastric) of cranial nerves.

3. From the sympathetic nervous system.

The intrinsic ganglia keep the heart beating, and the other two sets of nerves control the rate and force of the beat.

Systole is contraction of the heart and arteries for propelling the blood and thus carrying on circulation. The expansion of the heart is called **diastole**.

The heart has two sounds. The first is **longer** in duration and **lower** in pitch than the second. It is made by those sounds which take place during ventricular systole. (1) Muscular contractions. (2) friction of blood rushing through

the semilunar valves, (3) friction of the heart within the pericardium, (4) friction of heart against neighboring structures. It is of importance to study the normal heart sounds for any of these four factors may be modified by various diseases. The **second sound** of the heart is made by those sounds which occur during the closure of the aortic semilunar valves and the pulmonary semilunar valves. The position for hearing the **first sound** is at the **APEX**, while the **second sound** is more easily heard over the **BASE** of the heart.

The **tricuspid** and **pulmonary valves** are on a superficial plane to the **aortic** and **bicuspid valves**, thus a circle of one inch in diameter includes a part of all the valves of the healthy heart. The **tricuspid valve** is situated behind the median line of the sternum between the fourth costo-sternal articulations. The sound of this valve is best heard at **THE BASE OF THE ENSIFORM CARTILAGE**. The **aortic valve** is situated behind the left edge of the sternum on a level with the lower border of the third rib, and although this valve is on the left side of the heart we listen to its sounds in the **SECOND RIGHT OR AORTIC INTERSPACE** where they are conveyed. The **pulmonary valve** is situated behind the junction of the third costal cartilage with the sternum, and although it is situated on the right side of the heart its sounds are best heard in the **SECOND LEFT OR PULMONARY INTERSPACE** where the sounds are conveyed.

The **mitral valve** is situated between the left edge of the sternum and the third and fourth costal cartilages. We listen at **THE APEX** for this sound. Plate XVII.

THE THYROID GLAND. (Plates CXXI-CXXII-CXXXII.)

There are **several organs** in the body that are called ductless glands or bodies. They are the thymus gland, the thyroid gland, the spleen, and the suprarenal capsules. Some anatomists name the additional organs as ductless glands; the tonsils, the epiphysis, the hypophysis, the coceygeal glands and carotid glands. A gland is an organ which secrets and pours forth fluid from one or more ducts, and since these bodies just named have no ducts it would seem that they could not be called glands, however they have an internal secretion. The thyroid gland has a duct in the fetus which leads to the base of the tongue. This **gland** is very vascular and is situated upon the larynx and upper part of the trachea. Although closely associated with the trachea, yet it takes no part in respiration. It is the seat of the disease known as bronchocele or goiter. The following are the main forms of goiter:

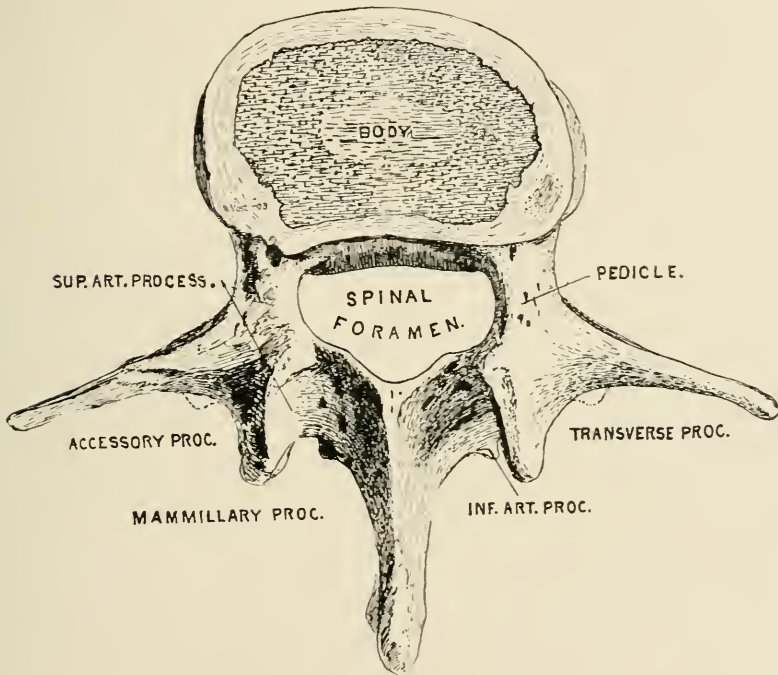
1. **EXOPHTHALMIC** (Grave's disease.) Where there is a great vascularity and often pulsation, accompanied by exophthalmus, palpitation, and rapid pulse.
2. **FIBROID**. Where there is an increase of the interstitial tissue.
3. **CYSTIC**. Where there are one or more cysts formed from dilatation and possibly coalescence of adjacent follicles.
4. **PULSATING**. Where vascular changes predominate.
5. **PARENCHYMATOUS**. Where the follicles are enlarged.

This gland consists of two lobes, which are pyriform in shape, and an isthmus. The dimensions of the lobes are two inches in length, three-quarters

of an inch in thickness, and an inch and a quarter in breadth. It extends from the middle of the thyroid cartilage to the sixth ring of the trachea, and the isthmus crosses the trachea about the third ring. The isthmus may, in rare cases, pass behind the trachea in front of the œsophagus. This gland weighs from one to two ounces. It is larger in the female and is increased in size during menstruation.

BLOOD SUPPLY.—The superior thyroid arteries, which are branches of the external carotid, supply the apex and inner and fore parts of the lateral lobes. The inferior thyroid arteries, which come from the thyroid axis, supply the

PLATE C.



A LUMBAR VERTEBRA.

outer and posterior portion of the lateral lobes. The thyroidea ima, which is derived either from the innominate artery or from the arch of the aorta, ascends on the front of the trachea to anastomose with the superior and inferior thyroid arteries and helps to supply the isthmus. The veins are the superior thyroid which empties into the internal jugular, and the middle thyroid which empties into the same, and the inferior thyroid which empties into the innominate of the corresponding side.

NERVE SUPPLY.—From the superior and middle cervical ganglion of the sympathetic, and possibly a branch from the tenth.

A goiter may be distinguished from a cervical tumor by the fact that it rises and falls on deglutition.

THE SPLEEN. (Plate CXLVII.)

The **dimensions** of the spleen are one by three by five inches, and it weighs about five ounces. It consists of an external portion called cortex, and an internal portion called the medullary portion. This internal portion consists of a honey-combed arrangement and in these cells are the Malpighian corpuscles which are about one-twenty-fifth of an inch in diameter. The spleen manufactures white blood corpuscles and has no true set of capillaries, the blood emptying into these spaces from which it is collected into the veins. There may be numerous accessory spleens. The spleen has no excretory duct and therefore no proper secretion. The Ancients thought the spleen to be the seat of various emotions. It is situated in the left hypochondriac region.

The relations of the spleen are as follows:

IN FRONT.—Stomach and splenic flexor of colon.

BEHIND.—The Diaphragm.

OUTER SIDE.—Diaphragm, ninth to eleventh ribs between the axillary line.

INNER SIDE.—Stomach, pancreas, left kidney, and suprarenal capsule.

BLOOD SUPPLY.—The splenic artery, which is a branch of the cœliac axis, divides before entering the spleen into about six branches. This artery is tortuous and large in proportion to the body it supplies. The spleen is entirely covered by peritoneum beneath which there is a plexus of lymphatic vessels. The lymphatics of the spleen are divided into a superficial and a deep set. The veins of the spleen form one main vein called the splenic which empties into the portal vein.

NERVE SUPPLY.—The splenic plexus which comes from the solar plexus and passes along the splenic artery.

LESSON LXVIII.

THE THYMUS GLAND. (Plate CXXXII.)

This **gland** is situated within the thorax behind the sternum near the neck. It is a fetal structure and begins to disappear about the second year after birth. The thymus gland of the sheep is called throat, or neck, sweet bread to distinguish it from the pancreas, or stomach sweet bread. This gland reaches its highest development about the second year and its weight it is six drachms.

BLOOD SUPPLY.—Internal mammary, superior and inferior thyroid. The veins empty into the left innominate vein and thyroid veins.

NERVE SUPPLY.—Sympathetic and pneumogastric.

SUPRARENAL CAPSULES. (ADRENAL BODIES.) (Plate CXLVII.)

These bodies are solid viscera situated on the upper extremity of each kidney. They are richly supplied with vessels and nerves. Dimensions are two inches by one-half by one-half. Weight is one drachm. They are not invested by peritoneum.

BLOOD SUPPLY.—Suprarenal, phrenic, and renal arteries, which pierce the organs chiefly on the anterior surface along a furrow called the hilum. The veins empty on the right side into the vena cava and occasionally by means of

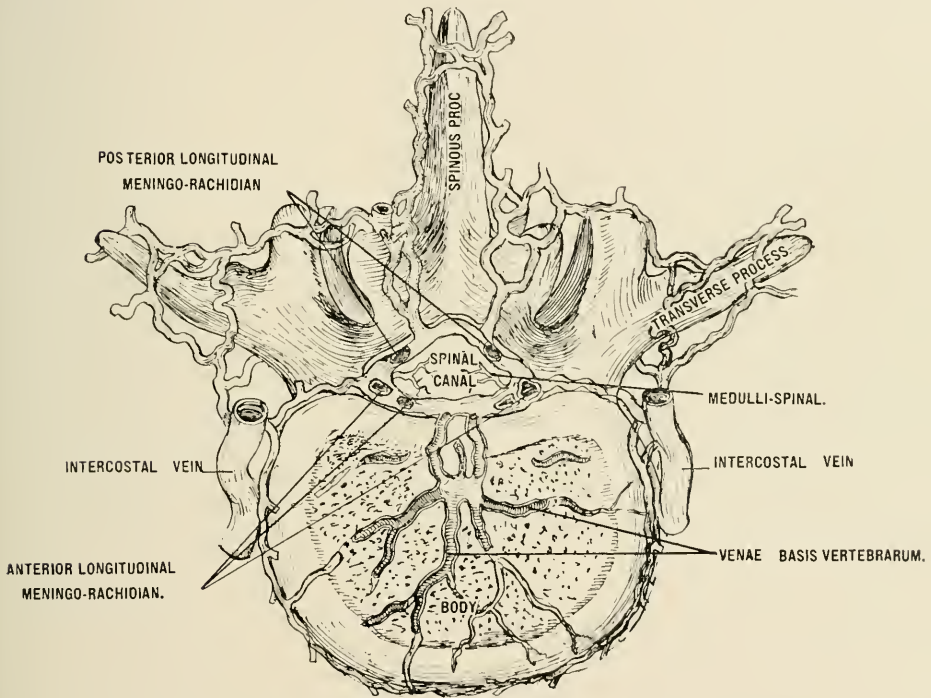
small branches into the phrenic and renal veins. Those on the left side empty into the renal vein. The lymphatics of this organ pass into the renal glands. The renal glands, as well as the suprarenal capsule, contain a good deal of pigment.

NERVE SUPPLY.—Solar and renal plexuses, and possibly the splanchnic, phrenic, and the pneumogastric nerves.

The other ductless glands mentioned will be described in their proper places.

PLATE CI.

DORSI-SPINAL VEINS



VEINS OF SPINAL CORD AND COLUMN (TRANSVERSE VIEW.)

LARYNX. (Plate CXXII.)

The **larynx** (the organ of phonation) is that part of the trachea in which vocal sound is made and modulated. It is the upper end of the trachea which is enlarged and modified. It opens by the glottis into the pharynx and is continuous below with the trachea. The larynx is larger in men than in women by about one-third. In some animals the larynx may be situated anywhere along the wind pipe or even in the bronchial tubes. In birds there are two larynges, one at the top of the trachea and the other, at the bottom of the trachea, which is called syrinx. The opening of the trachea is called the glottis. The word glottis is sometimes applied to this opening with the contiguous

structures as one might say œdema of the glottis just as he would say mouth to include the lips. The anterior part of the glottis is called glottis vocalis and is bounded by the true vocal cords, while the posterior part is called glottis respiratoria and is bounded by the internal margins of the arytenoid cartilages.

The **epiglottis** (Plates CXXII-CXXXIV-CXXXV-CXXXVI-CXXXVII.) is a valve-like organ which prevents the food from entering into the glottis during deglutition. The superior or false vocal cords are two folds of mucous membrane which enclose a delicate rounded band, the superior thyro-arytenoid ligament. They are called false vocal cords because they are not directly concerned in the production of the voice. The inferior or true vocal cords are two strong fibrous bands, inferior thyro-arytenoid ligament, which are covered by a thin layer of mucous membrane. They are called true vocal cords because they are concerned in the production of the voice.

The **sinus of the larynx**, (Plate CXXXVII) which is situated between the false and true vocal cords on each side, leads into the sacculus laryngis (sinus Morgagni.) There are nine cartilages of the larynx, three of which are single and three are in pairs. The single ones are (1) epiglottis, (2) thyroid, (3) cricoid. (Plate CXXXVI.) Those in pairs are (1) the two arytenoid, (2) two cornicula laryngis, and (3) the two cuneiform. The cricoid and thyroid and the arytenoid (excepting the tip) are hyaline in structure. The tip of the arytenoid, the epiglottis, the cornicula laryngis, and the cuneiform are yellow elastic. The ligaments of the larynx are arranged in two sets, the extrinsic which are three in number, connect the larynx to the hyoid bone, and the intrinsic, which are sixteen in number, connect the cartilages of the larynx to one another.

The **extrinsic ones are:**

Thyro-hyoid membrane. (Plate CXXXIV.)

Two lateral thyro-hyoid ligaments, each of which contains a nodule cartilage, (the cartilage triticea.)

The **sixteen intrinsic ligaments are:**

Crico-thyroid membrane. (Plate CXXXIV.)

Two crico-thyroid capsular ligaments.

Two crico-arytenoid ligaments.

Two crico-arytenoid capsular ligaments.

Two superior thyro-arytenoid (situated in the false vocal cords.)

Two inferior thyro-arytenoid (situated in the true vocal cords.)

Hyo-epiglottic ligament.

Thyro-epiglottic ligament.

Three glosso-epiglottic folds.

The **muscles of the larynx are as follows;** (1) Crico-thyroid, (2) Crico-arytenoideus posticus, (3) Crico-arytenoideus lateralis, (4) Thyro-arytenoideus (5) Arytenoideus, (6) Thyro-epiglottideus, (7) Aryteno epiglottideus superior, (8) Aryteno-epiglottideus inferior. All these muscles are in pairs except the Arytenoideus, which is a single muscle. Three of these muscles belong to the epiglottis. (Plate CXXXVI.)

LESSON LXIX.

CRICO-THYROID MUSCLE.

ORIGIN.—From the side of the cricoid cartilage.

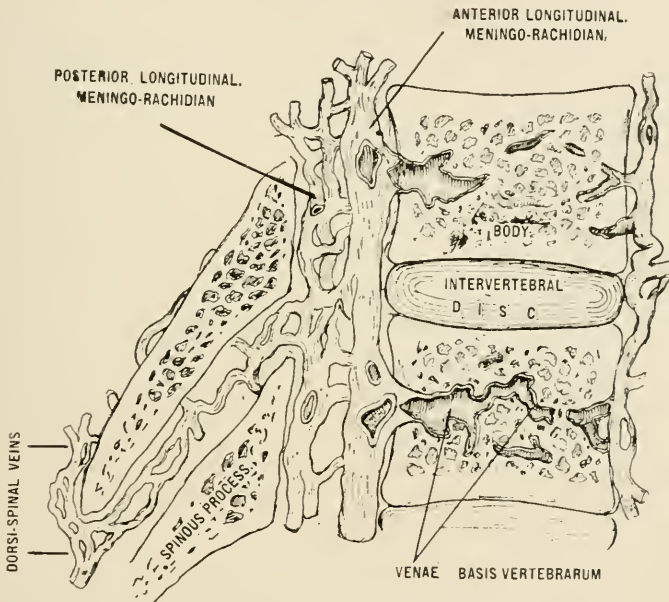
INSERTION.—Into the interior border and lower cornu of thyroid cartilage.

ACTION.—Rotates the posterior part of cricoid cartilage downward and backward, and thus tightens the vocal cords.

NERVE SUPPLY.—External laryngeal from the superior laryngeal.

BLOOD SUPPLY.—The superior laryngeal from the superior thyroid, and the inferior laryngeal from the inferior thyroid. The veins have the same name

PLATE CII.



VEINS OF SPINAL CORD AND COLUMN (SAGITTAL VIEW.)

as the arteries and accompany them. This is the blood supply of all the muscles of the larynx.

CRICO-ARYTENOIDEUS POSTICUS.

ORIGIN.—From posterior surface of the cricoid cartilage.

INSERTION.—Into the outer angle of the base of the arytenoid cartilage.

ACTION.—It dilates the glottis by rotating the arytenoid cartilage outward.

NERVE SUPPLY.—Recurrent laryngeal from the pneumogastric nerve.

CRICO-ARYTENOIDEUS LATERALIS.

ORIGIN.—From the upper border of the sides of the cricoid cartilage.

INSERTION.—Into the external angle of the base of the arytenoid cartilage in front of the Crico-arytenoideus posticus.

ACTION.—To contract the glottis by rotating the arytenoid cartilage inward.

NERVE SUPPLY.—Recurrent laryngeal from the pneumogastric.

THYRO-ARYTENOIDEUS.

ORIGIN.—From the side of the angle of the thyroid cartilage and the cricothyroid membrane.

INSERTION.—Into the anterior surface and base of the arytenoid cartilage.

ACTION.—Relaxes the vocal cords by drawing the arytenoid cartilage forward.

NERVE SUPPLY.—Recurrent laryngeal from the pneumogastric.

ARYTENOIDEUS MUSCLE.

ORIGIN.—This is the single muscle of the larynx and comes from the posterior surface of the arytenoid cartilage, its fibers running in a transverse direction pass from one cartilage to the other.

INSERTION.—Into the posterior surface of the arytenoid cartilage.

ACTION.—It assists in contracting the glottis by approximating the arytenoid cartilages.

NERVE SUPPLY.—Recurrent laryngeal from the pneumogastric, and the superior laryngeal.

THYRO-EPIGLOTTIDEUS.

ORIGIN.—From the angle of the thyroid cartilage just above the Thyro-arytenoideus.

INSERTION.—Into the lower border of the epiglottis and into the aryteno-epiglottic fold.

ACTION.—To compress the sacculus laryngis and to depress the epiglottis.

NERVE SUPPLY.—Recurrent laryngeal nerve.

ARYTENO-EPIGLOTTIDEUS SUPERIOR.

ORIGIN.—From the tip of the arytenoid cartilage.

INSERTION.—Into the mucous membrane attached to the side of the epiglottis.

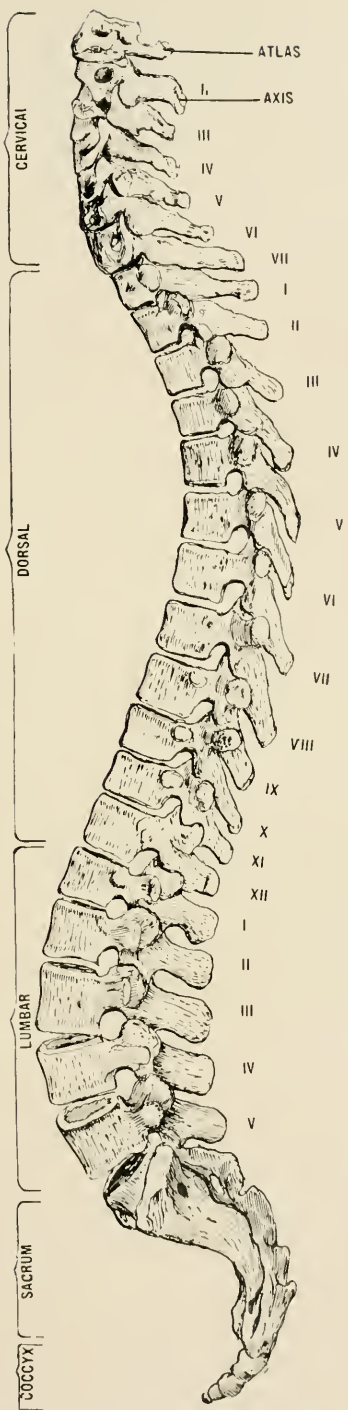
ACTION.—Contracts the superior opening of the larynx.

NERVE SUPPLY.—Recurrent laryngeal.

ARYTENO-EPIGLOTTIDEUS INFERIOR.

ORIGIN.—From the anterior surface of the arytenoid cartilage.

INSERTION.—Into the upper and inner part of the epiglottis. This muscle is separated from the superior muscle by a distinct interval. It is often called the Compressor sacculus laryngis of Hilton. The Triticeo-glottis muscle is a small muscle which is frequently present. Its origin is from the corpus triticeum, and after passing forward and upward to join the Cerato-glossus, it is inserted into the tongue.



THE SPINAL COLUMN.

ACTION.—Contracts the superior opening of the larynx.

NERVE SUPPLY.—Recurrent laryngeal nerve.

NERVE SUPPLY.—The Crico-thyroid muscles and mucous membrane of the larynx receive the superior laryngeal nerves, all the remaining muscles receive the inferior or recurrent laryngeal nerves. The Arytenoideus receives both superior and inferior laryngeal nerves.

BLOOD SUPPLY.—The laryngeal branches from the superior thyroid and inferior thyroid arteries pass to the larynx. The veins, which accompany the superior laryngeal artery, join the superior thyroid vein which empties into the internal jugular vein. The veins which accompany the inferior laryngeal artery join the inferior thyroid vein which empties into the innominate vein. The lymphatics pass into the deep cervical nodes.

TRACHEA. (Plate CXX.)

The word **trachea** comes from a Greek word which means rough. It is also called the wind pipe and is the air passage of the body beginning at the larynx and ending in the bronchial tubes. It is composed of sixteen to twenty cartilages or osseous rings. The first ring is called the cricoid cartilage, and the last one is called the pessulus. This last one is situated at the forking of the trachea into the right and left bronchial tubes. The trachea is a musculo-membranous tube and it communicates with the mouth and nose through the larynx, and with the lungs through the bronchial tubes. All vertebrates, which breathe air with lungs, have a trachea which is subject to very little variation in character. The human trachea is about four and one-half inches long, extending from the sixth cervical vertebra to the fourth dorsal vertebra where it branches into the two bronchi. The œsophagus is between the trachea and the spinal column. The average diameter of the trachea is about four-fifths of an inch in the cadaver. The antero-posterior diameter is somewhat less. During life these dimensions are smaller. The rings of the trachea are incomplete behind where they join the œsophagus.

BLOOD SUPPLY.—Inferior thyroid arteries. The veins terminate in the thyroid venous plexus.

NERVE SUPPLY.—Pneumogastric and sympathetic.

The **right bronchus** is about an inch in length and in direction is more horizontal in its passage to the root of the lung than the left bronchus. It is wider than the left and divides into three branches to the lung. The **left bronchus** is nearly two inches in length and is smaller, longer, and more oblique than the right one. It enters the root of the lung opposite the sixth dorsal vertebra, which is about an inch lower than the point where the right bronchus enters the lung. It divides into two branches. It has above it the arch of the aorta, behind it the œsophagus, thoracic duct, and the descending aorta. The left pulmonary artery is at first above, then in front of the left bronchus.

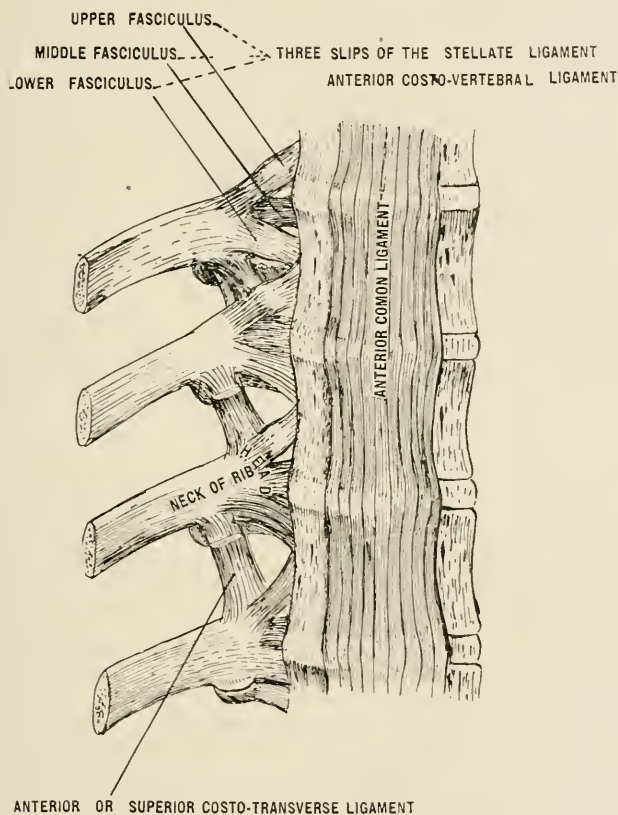
LESSON LXX.

LUNGS. (Plates CXXI-CXXII-CXXIII.)

The word **lung** comes from the Latin *pulmones*, from which comes *pul-*

monary. The lungs are two large organs which occupy a great part of the chest cavity. The heart, œsophagus, and the great vessels separate them. They are the organs of respiration in air breathing vertebrates and communicate with the pharynx through the trachea. The air cells (alveoli) are from one fiftieth to one-seventieth of an inch in diameter. The lungs are formed by repeated subdivisions of the bronchial tubes which finally end in saccular dilations called infundibula. The air cells are in the infundibula and the air pass-

PLATE CIV.



LIGAMENTS OF SPINAL COLUMN.

ages leading to them. These cells have a capillary net-work in which the branches of the pulmonary artery end and here the blood is separated from the air by the capillary wall and the thin alveolar epithelium of the air cells. The lung is comparatively compact, being composed of air breathing tubes bound up by connective tissue.

BLOOD SUPPLY.—From the bronchial arteries which vary in number, size, and origin. The one on the right side may come from (1) the first aortic intercostal, (2) by a common trunk with the left bronchial from the front of the thoracic aorta. On the left side there are generally two which come from the thoracic aorta. The bronchial veins do not return all the blood carried to the

lungs by the bronchial arteries, for that part which is distributed to the smaller bronchial tubes and alveolæ is brought back by the pulmonary veins. The right bronchial vein empties into the vena azygos major just before that vein empties into the superior vena cava. The left bronchial vein empties into the lower left superior intercostal vein or into the vena azygos tertius. Small veins from the bronchial glands, from the trachea, and from the posterior mediastinum empty into the bronchial veins at the root of the lung. The lymphatics of the lungs are numerous.

The **base of each lung** rests upon the Diaphragm and its **apex** passes through the superior opening of the thorax about an inch above the clavicle. Each lung is pyramidal in form and the right one is divided into an upper lobe, a middle lobe, and a lower lobe, while the left lung is divided into an upper lobe and a lower lobe. The root of each lung is little above the middle at the inner side and except for this attachment the lung lies free in the pleural cavity which it completely fills. The lung is elastic and always on a tension. The blood in passing through the lungs gives off carbon dioxide to the air in the alveolæ and receives oxygen. This process which takes place in the lung is a simple physical change and has nothing to do with any secreting or other activity of the epithelial cells.

NERVE SUPPLY.—It is from the anterior and posterior pulmonary plexuses, which are formed from the sympathetic and pneumogastric. Filaments from these plexuses accompany the bronchial tubes upon which they are lost. Small ganglia are formed upon these nerves.

The right lung (Plates CXXI-CXXII-CXXIII.) weighs twenty-two ounces and the left one twenty. Their capacity is nearly seven and a half pints. The entire respiratory surface is more than eight hundred and seventy square feet. At birth the lungs are a reddish brown and change to a rose pink on inflation. They are grayish white in adult life and brownish in middle life and bluish black in old age. The specific gravity varies from 345 to 746, water being 1000. The serous membrane which covers the lung is the pleura. (Plates CXXV-CXXVI.) Each pleura is an inclosed sac and they do not touch each other. Each has a parietal layer called a costal, and a visceral layer called pulmonary. The movements of the lungs in the chest are facilitated by serous secretion in the pleura. The parietal pleura has different names for its various portions.

1. THE **COSTAL PLEURA** is that which lines the ribs, costal cartilages, and intermediate muscles.

2. THE **DIAPHRAGMATIC PLEURA** is that which is attached to the Diaphragm.

3. THE **MEDIASTINAL PLEURA** is that which is attached to the adjacent structures in the mediastinum.

4. THE **CERVICAL PLEURA** is that which covers the dome of the lung.

BLOOD SUPPLY.—Internal mammary, intercostal, musculo-phrenic, thymic, pericardiac, bronchial. The veins correspond to the arteries. The lymphatics are numerous.

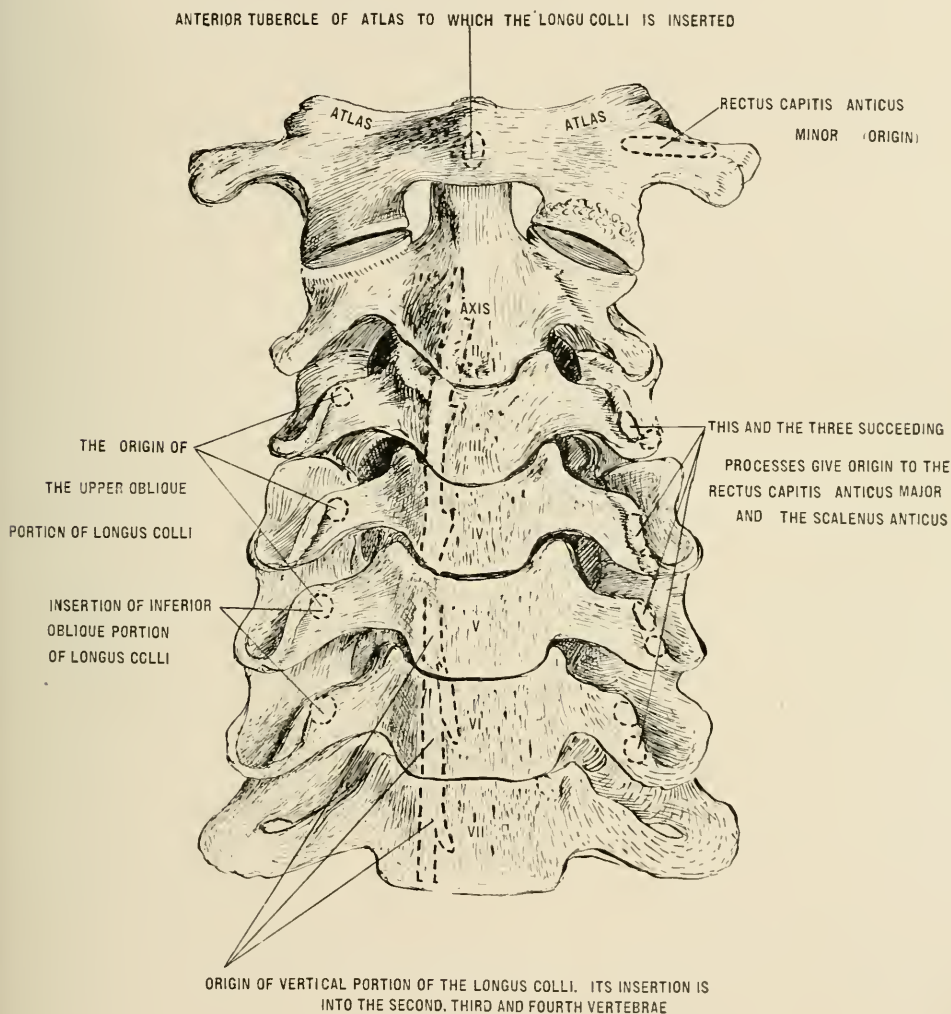
NERVE SUPPLY.—Sympathetic and phrenic.

The broad ligament of the lung is a fold of the visceral layer of the pleura which after covering the root of the lung comes together directly beneath it

forming a triangular sheet, passing vertically from the root of the lung to the Diaphragm, and laterally from the lung to the mediastinal pleura.

The **root of the lung** is composed of (1) the pulmonary artery, (2) pulmonary veins, (3) bronchial tube, (4) bronchial vessels, (5) anterior pulmonary plexus,

PLATE CV.



ANTERIOR VIEW OF CERVICAL VERTEBRÆ.

(6) posterior pulmonary plexus, (7) bronchial lymphatic nodes, (8) areolar tissue. All these are enclosed in the pleural covering. The first three of these are the main structures in the root of the lung and bear the following relations from before backward in each lung: Vein, artery, and bronchus. From above down in the left root we have artery, bronchus, and vein. In the right one from above down we have bronchus, artery and vein.

Relations of the root of the right lung. (Plate CXXVII.)

IN FRONT.—(1) Superior vena cava, (2) upper portion of right auricle of heart, (3) anterior pulmonary plexus, (4) right phrenic nerve.

BEHIND.—(1) Posterior pulmonary plexus, (2) pneumogastric nerve, (3) vena azygos major.

ABOVE.—(1) Vena azygos major.

BELOW.—Broad ligament (ligamentum latum pulmonis.)

Relations of the left root. (Plate CXXVII.)

IN FRONT.—(1) The anterior pulmonary plexus, (2) the left phrenic nerve.

BEHIND.—The descending aorta, (2) pneumogastric nerve, (3) posterior pulmonary plexus.

ABOVE.—The arch of the aorta.

BELOW.—The broad ligament (ligamentum latum pulmonis.)

About one hundred cubic inches of air remains in the lungs which cannot be expelled. (Plate CXXIV.) This is called **residual air**. After an ordinary expiration one hundred cubic inches of air can be expelled by forced expiration, this is called **reserve air**. About twenty or thirty cubic inches of air which passes in and out during the ordinary breathing is called **tidal air**. After an ordinary inspiration one can inhale one hundred and twenty cubic inches of air, which is called **complemental air**. After the supplemental air has been taken into the lungs then one may expell all the air, except the residual air, and this is called **vital capacity**.

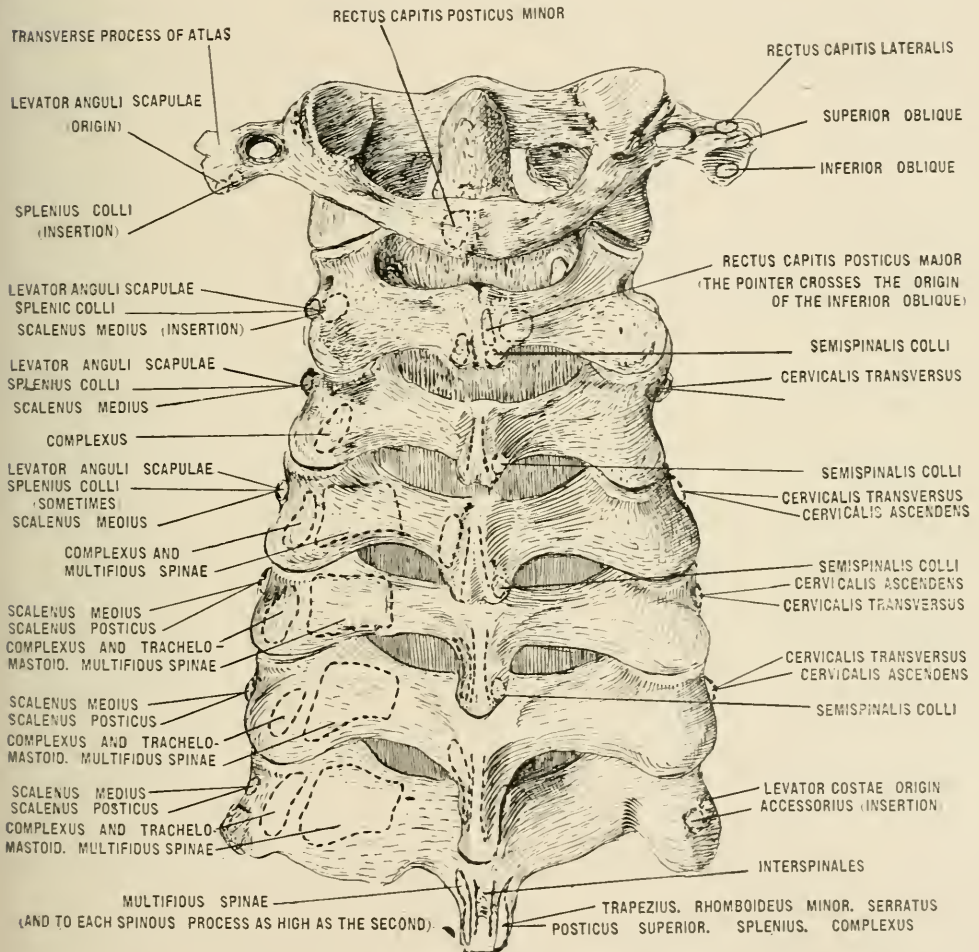
LESSON LXXI.

A **vertebra** (Plate XCIX) consists of a body and an arch, the latter being formed by two pedicles and two laminae which support the seven processes. The **body** is thick and spongy, convex in front from side to side and concave vertically on the upper and lower surfaces which are surrounded by bony rims. Anteriorly are small foramina for nutrient vessels, posteriorly a large foramen for the exit of the venae basis vertebrarum. The **pedicles** project backward from the body, inclining outward; they are noticed above and below, thus forming, with the adjacent notches, the intervertebral foramina for the entrance of vessels and the exit of spinal nerves. The **laminae** are two broad plates meeting in the spinous process behind and rough on the upper and lower borders for the attachment of the ligamenta subflava. The **transverse processes**, one on each side, project outward. The **articular processes**, two on each side, superior and inferior, project from the junction of the laminae and the pedicles, articulating above and below with the articular processes of the adjacent vertebrae. Their superior facets look upward in the cervical region, outward in the dorsal region, and inward in the lumbar. The **spinous process** projects backward from the junction of the laminae, sometimes very obliquely. The spinal foramen is the space enclosed by the body, pedicles, and laminae, and each foramen when the vertebrae are articulated, form part of the spinal canal.

There are **thirty-three vertebrae** in number, exclusive of those which form the skull, having received the names of **cervical, dorsal, lumbar, sacral**, and **coccygeal**, according to the position which they occupy, seven being found in

the cervical region, twelve in the dorsal, five in the lumbar, five in the sacral, and four in the coccygeal. (Plate CIII.) Their number is sometimes increased by an additional vertebra in one region, or the number may be diminished in one region, the deficiency being supplied by an additional vertebra in another. These observations do not apply to the cervical portion of the spine, the number

PLATE CVI.



POSTERIOR VIEW OF CERVICAL VERTEBRÆ.

of bones forming which is seldom increased or diminished.

The **peculiar vertebræ** are the FIRST CERVICAL OR ATLAS, SECOND CERVICAL OR AXIS, and THE SEVENTH CERVICAL OR VERTEBRA PROMINENS. (Plates XCV-XCVI-XCVII.) The great modifications in the form of the atlas and axis are designed to admit of nodding and rotary movements of the head.

The **peculiar vertebræ** in the dorsal region are the FIRST, NINTH, TENTH, ELEVENTH, and TWELFTH. (Plate CVII.) In the lumbar region THE FIFTH is

peculiar. The peculiarity of the first dorsal is that it has one facet and a demi-facet. The ninth dorsal has a demi-facet only. The tenth has but one facet on its body and one on the transverse process. The eleventh and twelfth have each but one facet on the body, and none on the transverse process. The twelfth resembles a lumbar vertebra in size and shape. The fifth lumbar is much deeper in front than behind. Its spinous process is small, but its transverse processes are large and thick and point slightly upward.

The **atlas** has ten pairs of muscles attached to it.

To anterior arch.	Longus Colli.	1 Ant. vertebral region.
To posterior arch.	Rectus capitis posticus minor.	2 Fifth layer of back.
	Rectus capitis anticus minor.	3 Ant. vertebral region.
	Rectus capitis lateralis.	4 Ant. vertebral region.
	Inferior oblique.	5 Fifth layer of back.
To transverse process.	Superior oblique.	6 Fifth layer of back.
	Splenius colli.	7 Third layer of back.
	Levator anguli scapulæ.	8 Second layer of back.
	Anterior intertransversalis.	9 Fifth layer of back.
	Posterior intertransversalis.	10 Fifth layer of back.

THE **ATLAS** has a small spinous process, large lateral masses, and no body. The anterior arch forms one-fifth of the circumference, the posterior arch two-fifths of the circumference, and the lateral masses one-fifth each. The attachment of muscles is given above. There is a groove on the posterior surface of the anterior arch for the articulation of the odontoid process of the axis. This process is held in place by the transverse ligament which passes across it posteriorly, being attached to the inner surface of the lateral masses. Where the posterior arch joins the lateral masses there is a groove (*sinus atlantis*) for the vertebral artery and suboccipital nerve (first spinal nerve), the nerve lying beneath the artery. The articulation of the atlas with the occiput is a diarthrosis joint, subclass double condylar arthrosis, having all the movements of the ball-and-socket joint (enarthrosis) except axial rotation. (Plate XCV.)

The **blood supply** of this joint is the vertebral artery and sometimes the ascending pharyngeal artery.

The **nerve supply** is the anterior division of the suboccipital (first cervical.)

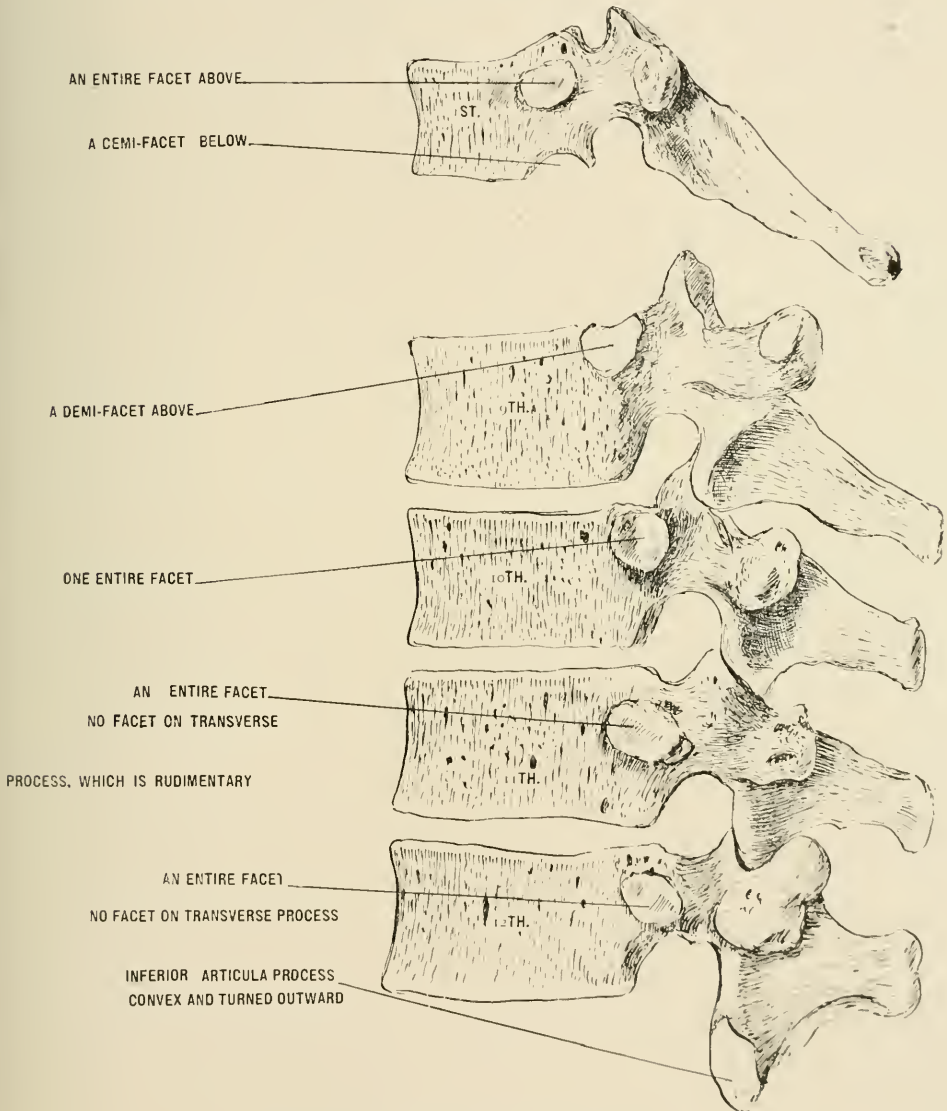
The ligaments are the anterior occipito-atlantal, posterior occipito-atlantal, two capsular, two anterior oblique or lateral occipito-atlantal. (Plate CIX.)

The **anterior occipito-atlantal ligament** is attached above to the anterior margin of the foramen magnum, below to the upper margin of the anterior arch of the atlas. The central part, which is a continuation of the anterior common ligament of the vertebral column, is sometimes called the superficial part of this ligament. The lateral portions, which are continuous with the capsular ligament, form the deep part. In front of this ligament are the *Recti capitis antici minores* muscles. Behind is the central odontoid or suspensory ligament.

LESSON LXXII.

The **posterior occipito-atlantal ligament** is attached above to the posterior margin of the foramen magnum from condyle to condyle, below to the pos-

PLATE CVII.



THE PECULIAR DORSAL VERTEBRÆ.

terior surface and upper margin of the posterior arch of the atlas. This ligament is incomplete on each side for the passage of the vertebral artery into, and the suboccipital nerve from, the spinal canal. In position it corresponds

to the ligamenta subflava which are below the axis but has no elastic tissue in its composition. In front this ligament is attached to the dura mater and behind are the Rectus capitis posticus minor and Superior oblique muscles.

The **two capsular ligaments** are attached above to the margins of the condyles of the occipital bone and below to the margins of the articular surfaces of the atlas. Each capsular ligament is lined with synovial membrane which sometimes communicates with the synovial membrane of the transverse odontoid ligament.

The **two anterior oblique or lateral occipito-atlantal ligaments** are situated in front of the external part of the capsular ligament. They are attached above to the jugular process of the occipital bone, and below to the base of the transverse process of the atlas. Their direction is forward, upward, and inward.

The articulation of the lower part of the atlas with the upper part of the axis is a diarthrodial joint, subclass arthrodial. The nerve supply is the **loop between the first and second cervical nerves**. The **blood supply** is the vertebral artery. The ligaments are anterior atlanto-axial, posterior atlanto-axial, transverse, and two capsular.

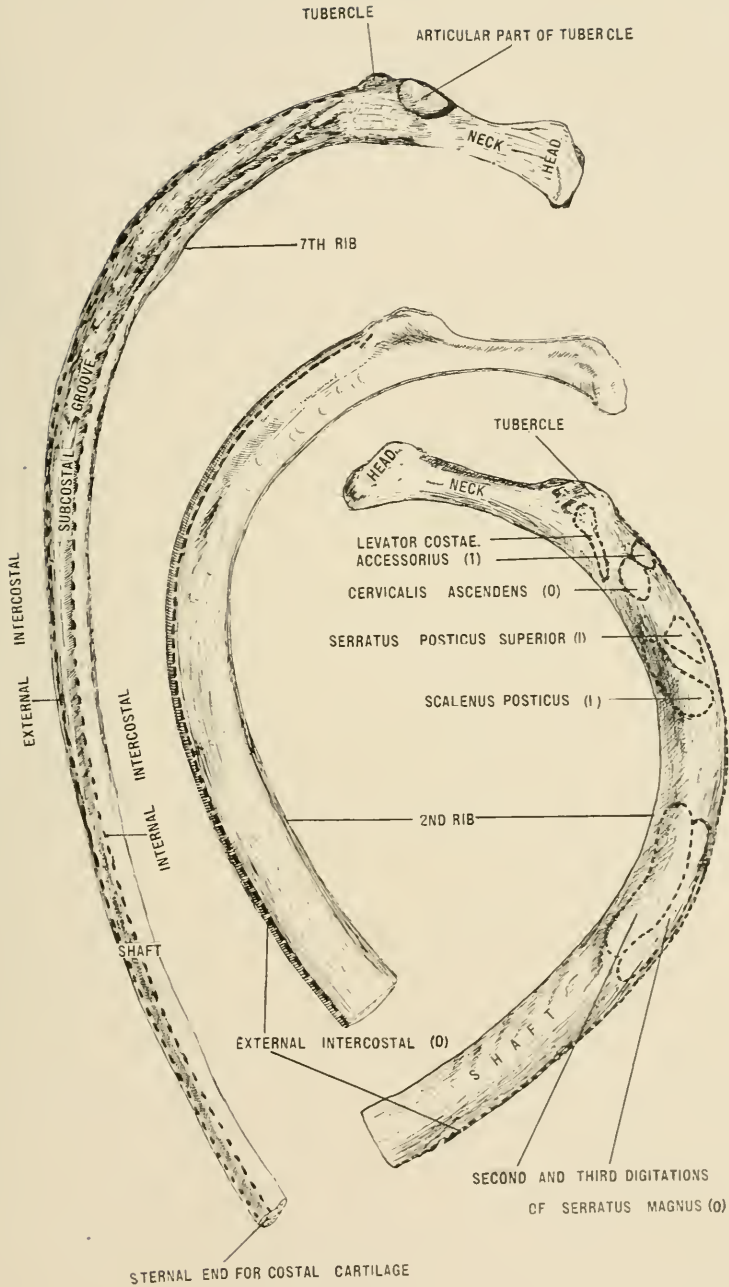
The **anterior atlanto-axial ligament** is attached above to the anterior surface and lower border of the anterior arch of the atlas, and below to the base of the odontoid process and the transverse ridge on the front of the body of the axis. It is continuous on each side with the capsular ligaments. In front in the median line is the anterior common ligament of the vertebral column which is sometimes called the superficial anterior atlanto-axial ligament. It has immediately in front the Longus colli, then the Recti capitis antici minores.

The **posterior atlanto-axial ligament** takes the place of the ligamenta subflava of the joints below the axis. It is attached above to the posterior surface and lower edge of the posterior arch of the atlas and below to the dorsal aspect of the upper edge of the lamina of the axis. It is continuous with the capsular ligament on each side. It is perforated on each side by the second cervical nerve. In front it is connected to the dura mater, behind is the Inferior oblique muscle.

The **two capsular ligaments**. These articulations are between the superior articular surfaces of the axis and inferior articular surface of the atlas. Each joint has a loose capsular ligament and synovial sac. These ligaments are strengthened in front and behind by the anterior and posterior atlanto-axial ligaments.

The **transverse ligament** is a strong fibrous band passing from the tubercles on the inner side of the lateral masses of the atlas, holding the odontoid process in place. It is thicker in the center and gives fibers which pass above to the basilar process of the occipital and some passing below to the base of the odontoid process and body of the axis, thus forming a crucial ligament. This ligament divides the canal of the atlas into two parts, a small anterior one which is for the odontoid process and a large posterior one for the spinal cord, the spinal accessory nerves, the spinal arteries, vertebral arteries, and the meninges of the cord.

The articulation of the posterior surface of the anterior arch of the atlas



THE SECOND AND SEVENTH RIBS.

with the odontoid process is a diarthrosis joint, subclass trochoides. **Blood supply**, vertebral and ascending pharyngeal arteries. **Nerve supply**, loop between the first and second cervical nerves. The part between the posterior surface of the odontoid process and the transverse ligament is a syndesmo-odontoid joint. Each of these joints has a synovial membrane. The synovial membrane of the atlanto-odontoid is surrounded by a capsular ligament of the same name and is continued with the occipito-atlantal capsular ligament. It blends with the anterior occipito-atlantal, atlanto-axial, and the central odontoid ligaments. The synovial sac of the syndesmo-odontoid joint is surrounded by a capsule. This sac often communicates with the occipito-atlantal synovial sac.

The ligaments attached to the odontoid process are (1) **Occipito-axial ligament** (apparatus ligamentosus colli) which is a continuation of the posterior common ligament of the vertebral column, some of the fibers continuing to the anterior margin of the foramen magnum to be continued by the dura mater. This covers the odontoid process and its ligaments.

(2) **Crucial ligament**, the same as the transverse ligament.

(3) Two **lateral odontoid or check ligaments** passing from the sides of the apex of the odontoid process to the inner surface of the condyles of the occipital bone, their direction being outward, upward, and forward.

(4) The **central odontoid or suspensory ligament** is attached to the tip of the odontoid process below, and to the under surface of the anterior margin of the foramen magnum above. It has in front the anterior occipito-atlantal ligament and behind is the upper division of the crucial ligament.

LESSON LXXIII.

The **axis** is the second cervical vertebra. (Plates XCVI-XCVII.) Its peculiarity is that it has an odontoid process which is in reality the body of the atlas. Its spinous process is bifid. It has fourteen pairs of muscles attached.

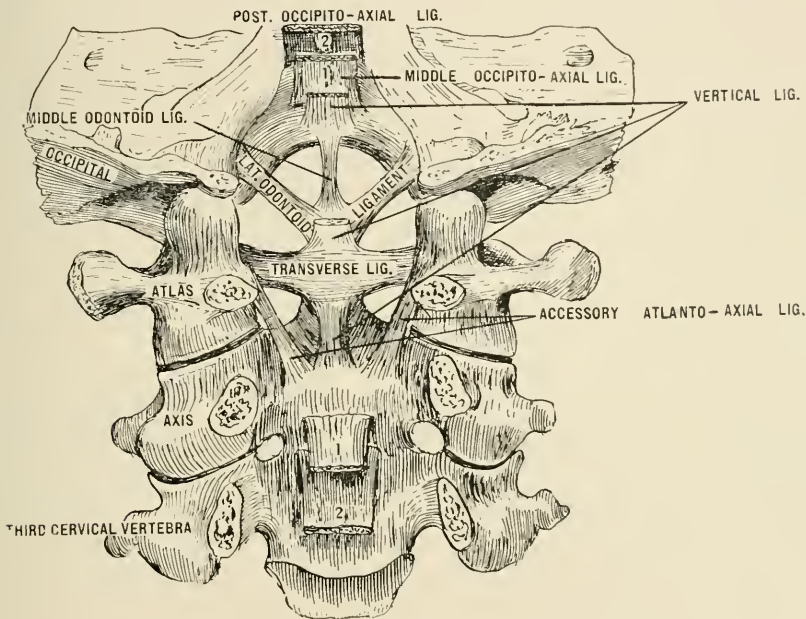
To body	Longus colli	1 Ant. vertebral region.
	Inferior oblique	2 Fifth layer of back.
	Rectus capitis posterior major	3 Fifth layer of back.
	Semispinalis colli	4 Fifth layer of back.
To spinous process	Spinalis colli	5 Fourth layer of back.
	Interspinales	6 Fifth layer of back.
	Multifidus spinæ	7 Fifth layer of back.
	Supraspinales	8 Fifth layer of back.
	Splenius colli	9 Third layer of back.
To transverse process.	Anterior intertransversalis	10 Fifth layer of back.
	Posterior intertransversalis	11 Fifth layer of back.
	Levator anguli scapulae	12 Second layer of back.
	Transversalis colli or cervicis	13 Fourth layer of back.
	Scalenus medius	14 Lateral vertebral region.

The **seventh cervical** is the last cervical and has characteristics of both cervical and dorsal vertebrae. It is called vertebra prominens on account of its

large spinous process. Its transverse process may, or may not, have the costo-transverse foramina. The vertebral artery and vein more often pass in front of the transverse process than through its foramen; they more often pass through the left foramen than the right one and the vein more often than the artery.

The anterior tubercle of the transverse process, which is an analogue of the rib, may be enlarged, making a rudely developed cervical rib. This vertebra has eighteen pairs of muscles attached to it.

PLATE CIX.



LIGAMENTS OF UPPER CERVICAL VERTEBRÆ.

To body	Longus colli	1 Ant. vertebral region.
	Trapezius	2 First layer of back.
	Rhomboideus minor	3 Second layer of back.
	Serratus posticus superior	4 Third layer of back.
To spinous process	Splenius capitis	5 Third layer of back.
	Multifidus spine	6 Fifth layer of back.
	Interspinales	7 Fifth layer of back.
	Semispinalis dorsi	8 Fifth layer of back.
	Spinalis colli	9 Fourth layer of back.
	Anterior intertransversalis	10 Fifth layer of back.
	Posterior intertransversalis	11 Fifth layer of back.
	Levatores costarum	12 Thoracic region.
To transverse process	Scalenus posticus	13 Lateral vertebral region
	Scalenus medius	14 Lateral vertebral region.

To transverse process.	Musculus accessorius	15 Fourth layer of back.
	Complexus	16 Fourth layer of back.
To articular process	Multifidus spinæ	17 Fifth layer of back.
	Trachelo-mastoid	18 Fourth layer of back.

LESSON LXIV.

The ligaments of the vertebral column are: (Plate CIV.)

1. **Ligaments of the body:**
 - a. Anterior common.
 - b. Posterior common.
 - c. Intervertebral substance.
 - d. Lateral or short ligament.
2. **Ligaments connecting the laminæ:**
 - a. Ligamenta subflava.
3. **Ligaments connecting the articular processes:**
 - a. Capsular.
4. **Ligaments connecting the spinous processes.**
 - a. Supraspinous.
 - b. Interspinous.
5. **Ligaments connecting the transverse processes:**
 - a. Intertransverse.

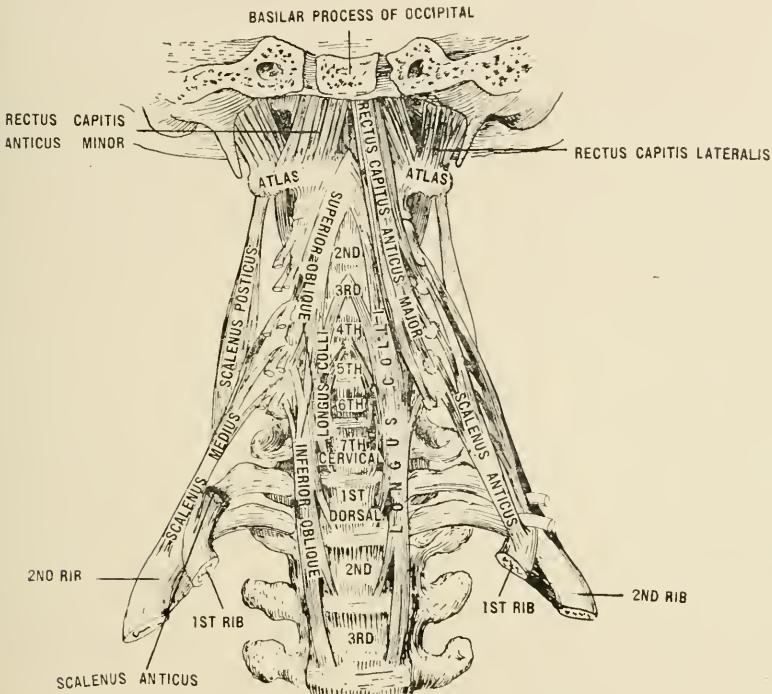
The **anterior common ligament** is a fibrous band extending from the anterior tubercle of the atlas to the base of the sacrum. Its upper part makes the anterior atlanto-axial ligament and its lower part extends to make the anterior sacro-coccygeal ligament. It is broader below than above and thickest in the dorsal region and thinnest in the cervical. It is thicker over the bodies of the vertebræ than over the intervertebral substance. The interarticular substance and the margins of the bodies of the vertebræ give attachment to the ligament more than the anterior surface of the bodies. There are apertures at the sides of the median position of the body for the passage of vessels. This ligament consists of three layers of various lengths closely intermingled; the superficial layer passes from one vertebra to the fourth or fifth above; the second layer from one vertebra to the second or third above; and the third layer connect adjacent vertebræ.

The **posterior common ligament** is situated along the anterior part of the spinal canal upon the posterior surface of the bodies of the vertebræ, extending from the basilar process of the occipital above, to the coccyx below, its upper part making the posterior occipito-axial ligament. It is broader above (which is the reverse of the anterior common ligament,) thickest in the dorsal region, and, like the anterior one, it is attached to the intervertebral discs and adjacent margins of the vertebræ. It is narrow and thick over the bodies from which it is separated by adipose tissue and the *venæ basis vertebrarum*. Opposite the intervertebral substance it gives off dentated processes. The *filum terminale* of the spinal cord blends with this ligament at the back of the base of the coccyx. Its fibers are not so intermingled as those of the anterior common ligament and

consist of two layers, the superficial extends from one vertebra to the third or fourth, and the deeper connect adjacent vertebræ.

The **intervertebral substance** or **discs** forms about one-fourth of the spinal column. They conform to the shape of the bones adjacent. They are thicker at the anterior than at the posterior border in the cervical and lumbar regions,

PLATE CX.



MUSCLES OF ANTERIOR VERTEBRAL REGION.

thus helping to form the curve in these regions, while in the dorsal or thoracic region they are of a uniform thickness, the difference in the thickness of the bodies of the vertebræ making the curve in this region. They form the main bond between the bodies of the vertebræ; they are compressible, elastic, and tough. In number they are twenty-three, extending from the axis to the sacrum. They consist of an outer ring and an inner substance, the ring is composed of fibro-cartilagenous tissue of concentric layers. The fibers of the layers are not parallel but pass into the layers above and below. The central substance has cartilage cells set in fine connective tissue matrix.

The **lateral or short vertebral ligaments** connect the adjacent margins of the bodies of the vertebræ between the anterior and posterior common ligaments with which they are continuous. In the dorsal region they overlies the stellate ligaments and in the lumbar they radiate towards the transverse processes. In the cervical region they are less well marked.

The **ligamenta subflava** connect the laminae between the axis and the sac-

rum. They are very thin, but broad and long in the cervical region; they are thicker in the dorsal, being very thick in the lumbar region. They consist of yellow elastic tissue. Their fibers are almost perpendicular. They are attached above to the inner surface of the inferior articular process and the inner surface of the lower margin of the lamina of the vertebræ; below to the inner surface of the superior articular process and the upper margin of the lamina. They are continuous with the interspinous ligament at the root of the spinous processes and help to form the capsular ligament.

The **capsular ligaments** connect the articular processes, being attached along the margins of the articular surfaces; the lateral part of the ligamenta subflava forms their inner portion. Each joint is lined by a synovial membrane. These ligaments are short and tight in the thoracic region, loose in the cervical, and intermediate in the lumbar.

The **supraspinous ligaments** are fibrous bands connecting the tips of the processes, extending from the tip of the vertebra prominens to the first sacral. It is continued above as the ligamentum nuchæ and below along the spines of the sacrum.

The **interspinous ligaments** extend in all regions of the vertebral column between the spinous processes of the vertebræ, running from root to apex. In the cervical region they are very delicate and are separated by the Interspinales muscles. They are stronger in the lumbar than in the dorsal region.

The **intertransverse ligaments** extend between the transverse processes of the vertebræ; in the cervical region they are often absent, the Intertransversales muscles taking their place. They are better marked in the dorsal region; in the lumbar region they are weak and membranous.

LESSON LXXV.

Each rib has the following points: (Plate CVIII.)

Head which is divided by a ridge into two facets, and these articulate with the facets on the bodies of the dorsal vertebræ; the ridge giving attachment to the interarticular ligament.

Neck, about an inch long, having attached to its upper border the anterior costo-transverse ligament, to its posterior surface the middle costo-transverse ligament; its anterior surface is smooth.

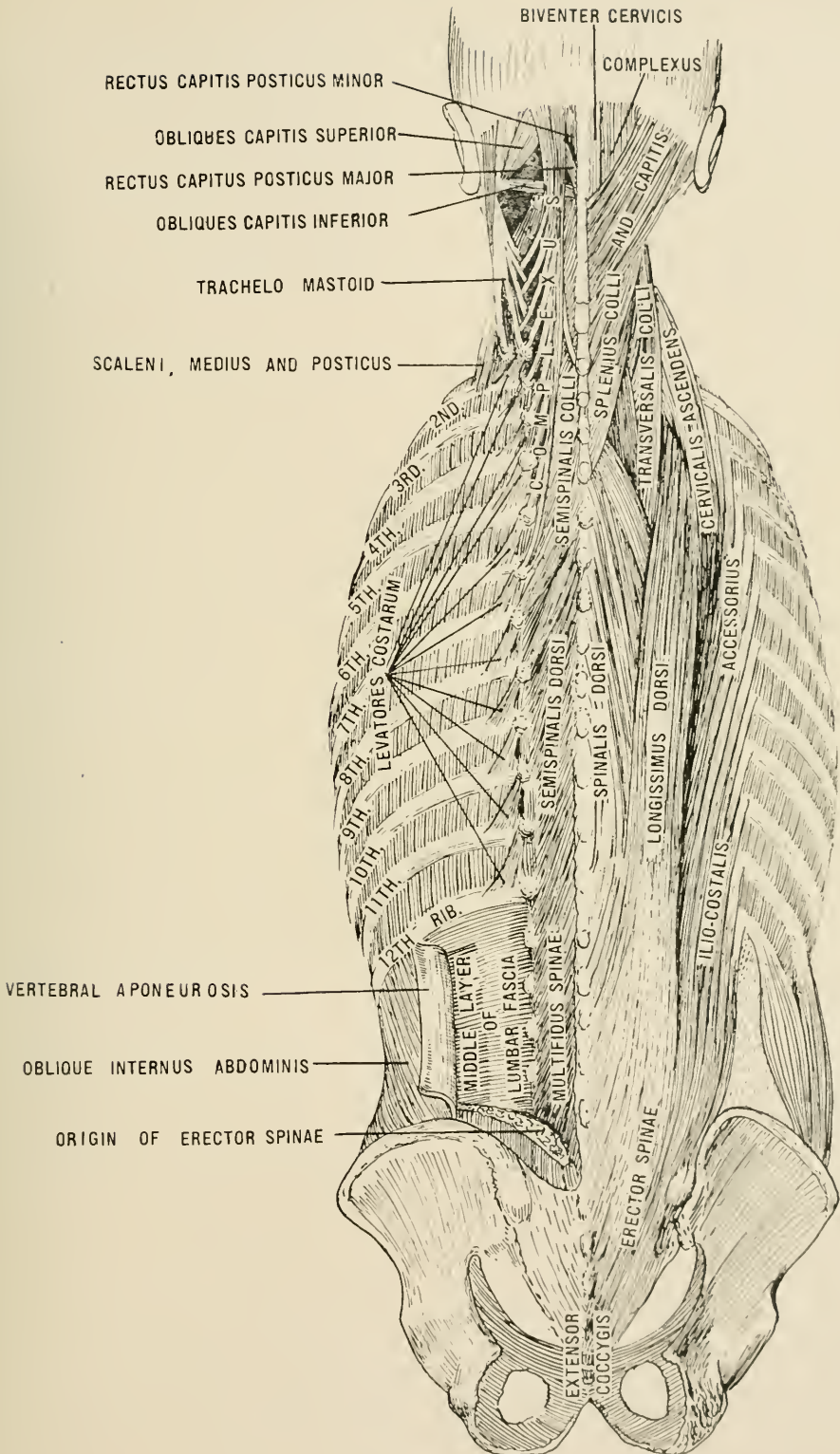
Tuberosity, at the junction of the neck with the shaft, has a facet for articulation with the transverse process of the next lower vertebra, and a rough surface for the posterior costo-transverse ligament.

Shaft, twisted on itself, is concave internally, convex externally, its upper border round and smooth, its lower border grooved for the intercostal vessels and nerves. At its external extremity is an oval depression for the insertion of the costal cartilage.

Angle, just in front of the tuberosity, is marked by a rough line, to which are attached the muscles of the deep layer of the back.

Each rib is developed in the following manner:

Each rib has three centers, one for the head, one for the shaft, and one for



MUSCLES OF BACK (DEEP LAYER).

the tuberosity. The last two ribs, having no tuberosity, are developed each by two centers.

The peculiar ribs are the **first, second, tenth, eleventh, and twelfth**. They respectively present the following peculiarities, viz:

First Rib is BROAD, SHORT, not TWISTED, has NO ANGLE, only ONE FACET on the head, but on its upper surface are seen TWO GROOVES for the subclavian artery and vein, and between them a TUBERCLE for the Scalenus anticus muscle.

Second Rib is not TWISTED, its TUBEROSITY AND ANGLE are very close together, and its upper surface presents ROUGH SURFACES for the Serratus magnus and Scalenus posticus muscles.

Tenth Rib has but ONE FACET on its head.

Eleventh Rib has NO NECK, no TUBEROSITY, and but ONE FACET on its head.

Twelfth Rib has NEITHER NECK, ANGLE, TUBEROSITY nor GROOVE, and but ONE FACET.

MUSCLES OF THE BACK.

The **muscles of the back** are arranged in five layers. (Plates XVIII-CXI) Those in the fourth layer get both the internal and external divisions of the posterior branches of the spinal nerves. The external divisions supply those in the third layer. The internal divisions together with the sub-occipital and great occipital supply those in the fifth layer. (Plates XVIII-CXI.)

First layer.

- 1 Trapezius. See page 45.
- 2 Latissimus dorsi. See page 52.

NERVES.

Spinal accessory; 3rd and 4th cervical.
Middle or long subscapular.

Second layer.

- 1 Levator angulæ scapulæ. Page 54.
- 2 Rhomboidæ minor. Page 55.
- 3 Rhomboidæ major. Page 55.

3rd and 4th cervical; sometimes 5th.
5th cervical.
5th cervical.

Third layer.

- 1 Serratus posticus superior.
- 2 Serratus posticus inferior.
- 3 Splenius capitis.
- 4 Splenius colli.

External divisions of the posterior branches of the spinal nerves, in their respective regions.

Fourth layer.

SACRAL AND LUMBAR REGIONS.

- 1 Erector spinæ.

DORSAL REGION.

- 2 Ilio-costalis.
- 3 Musculus accessorius ad ilio-costalem
- 4 Longissimus dorsi.
- 5 Spinalis dorsi.

All the muscles in the fourth layer get the external divisions of posterior branches except the Spinalis dorsi and Spinalis colli and the Complexus.

CERVICAL REGION.

- 6 Cervicalis ascendens.
- 7 Transversalis colli.
- 8 Trachelo-mastoid.
- 9 Complexus.

They get the internal divisions of the posterior branches. The Complexus also gets the sub-occipital and the great occipital nerves.

10 Biventer cervicis.

11 Spinalis colli.

Fifth layer.

1 Semispinalis dorsi.

2 Semispinalis colli.

3 Multifidus spinæ.

4 Rotatores spinæ.

5 Supraspinales.

6 Interspinales.

7 Extensor coccygis.

8 Intertransversales.

9 Rectus capitis posticus major.

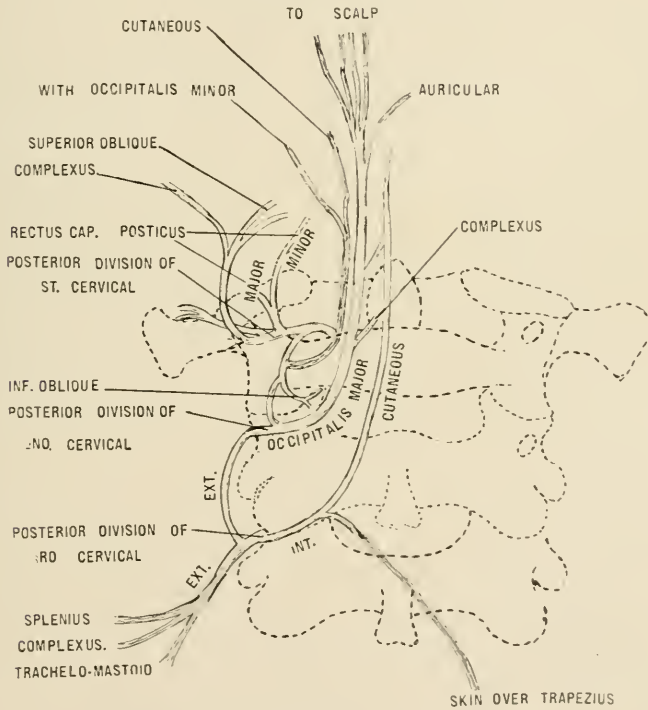
10 Rectus capitis posticus minor.

11 Obliquus capitis superior.

12 Obliquus capitis inferior.

All these muscles in the fifth layer are supplied by the internal divisions of the posterior branches of the spinal nerves in their respective regions, except the Recti and Obliqui, and they are supplied by the sub-occipital. The Inferior oblique also takes the great occipital nerve.

PLATE CXII.



THE POSTERIOR CERVICAL PLEXUS.

MUSCLES OF THE THIRD LAYER.

Serratus posticus superior.—DESCRIPTION.—This muscle is quadrilateral and has a serrated outer margin. The inner half of the muscle is tendinous and the outer half is fleshy. It takes its name from its serrated edge and its position.

ORIGIN.—(1) Ligamentum nuchæ, (2) spinous processes of the seventh

cervical and first, second, third, and fourth dorsal vertebræ, (3) supraspinous ligament.

INSERTION.—Into the upper borders of the second, third, fourth, and fifth ribs beyond their angles.

ACTION.—To assist in inspiration by raising the ribs into which it is inserted.

NERVE SUPPLY.—External divisions of the posterior branches of the spinal nerves.

BLOOD SUPPLY.—The muscles in the back are supplied by (1) occipital, (2) vertebral, (3) intercostal, (4) subclavian (thyroid axis), (5) lumbar arteries. This applies to all the muscles in the back.

Serratus posticus inferior.—**DESCRIPTION.**—This muscle takes its name from its serrated edge and its position. More than half of this muscle is aponeurosis, which blends with the posterior layer of the lumbar fascia. Its outer portion is fleshy.

ORIGIN.—(1) Spinous processes of the eleventh and twelfth dorsal, and first, second, and third lumbar vertebræ, (2) supraspinous ligament.

INSERTION.—Into the lower borders of the ninth, tenth, eleventh, and twelfth ribs beyond their angles.

ACTION.—It assists in inspiration by depressing the lower ribs, and making them a fixed point so the diaphragm can contract.

NERVE SUPPLY.—External divisions of the posterior branches of the spinal nerves. The nerve supply of the remaining muscles of the back is given in the first part of this lesson.

Splenius capitis and Splenius colli.—**DESCRIPTION.**—This is a broad muscle which divides above into two portions for insertion. It takes its name (band-age) on account of it holding down the Complexus and other muscles.

ORIGIN.—This muscle has one origin and two insertions and may be called two muscles. (1) Lower one-half of the ligamentum nuchæ, (2) spinous processes of the seventh cervical, and upper six dorsal vertebræ, (3) supraspinous ligament.

INSERTION.—(Capitis portion). (1) mastoid process of temporal bone, (2) occipital bone beneath the superior curved line. (Colli portion) into the transverse processes of the first, second, and third cervical vertebræ (posterior tubercles.)

ACTION.—It flexes the head and neck, laterally, extends them, and rotates the face to same side.

LESSON LXXVI.

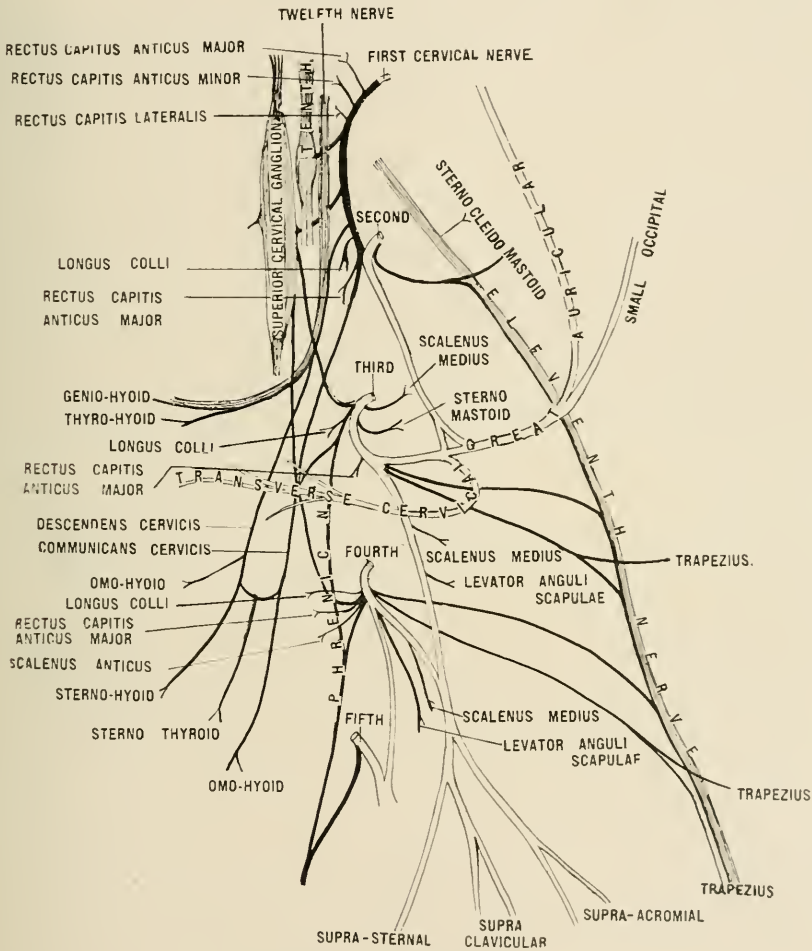
MUSCLES OF THE FOURTH LAYER OF THE BACK.

Erector Spinae.—**DESCRIPTION.**—This muscle and its continuations fill up the vertebral groove on each side of the spine. In the sacral region this muscle is pointed and tendinous. In the lumbar region it is larger and fleshy. In the dorsal region it divides into its branches, and these sub-divide. This muscle is covered in the lumbar region by the lumbar fascia; in the dorsal region

by the Serrati muscles, and the vertebral fascia, and in the cervical region by a layer of cervical fascia.

ORIGIN.—(1) Spines of the eleventh and twelfth dorsal vertebræ, (2) all the lumbar and sacral spines, (3) supraspinous ligament of all these, (4) back

PLATE CXIII.



THE CERVICAL PLEXUS.

part of the inner lip of the crest of the ilium, (5) posterior surface of the sacrum external to the spinous processes.

INSERTION.—This muscle extends clear to the head by its numerous subdivisions and these are its insertion.

ACTION.—To extend the lumbar spine on the pelvis.

Ilio-costalis.—(Sacro-lumbalis.)—DESCRIPTION.—This muscle takes its name from its attachments to the ilium and the ribs.

ORIGIN.—From the outer part of the Erector spinae.

INSERTION.—Into the inferior borders of the angles of the six or seven lower ribs. It sometimes may include all the ribs.

ACTION.—To draw down the chest and spine.

Musculus accessorius ad ilio-costalem (ad sacro-lumbalem.)—**DESCRIPTION.**—This muscle is narrow with a serrated margin on each side. It takes its name from being an accessory to the Ilio-costalis.

ORIGIN.—From the upper borders of the angles of the six lower ribs by separate tendons.

INSERTION.—(1) Upper borders of the angles of the six upper ribs, (2) back of transverse process of the seventh cervical vertebra.

ACTION.—To assist the Erector spinæ.

Longissimus dorsi.—**DESCRIPTION.**—This muscle takes its name from its length and position.

ORIGIN.—(1) From the middle part of the Erector spinæ, (2) transverse processes of the lumbar vertebrae, (3) middle lamina of lumbar fascia.

INSERTION.—(1) Tips of transverse processes of all the dorsal vertebrae, (2) between the tubercles and angles of the lower ribs (seventh to eleventh.)

ACTION.—To draw down the chest and spine.

Spinalis dorsi.—**DESCRIPTION.**—This muscle takes its name from its attachment to the spines in the dorsal region.

ORIGIN.—From spinous processes of eleventh and twelfth dorsal and first and second lumbar vertebrae.

INSERTION.—Into the spinous processes of the six or eight upper dorsal vertebrae.

ACTION.—To extend the dorsal region of the spine.

Cervicalis ascendens.—**DESCRIPTION.**—This muscle takes its name from its position and direction.

ORIGIN.—From angles of the four or five upper ribs.

INSERTION.—Posterior tubercles of transverse processes of fourth, fifth and sixth cervical vertebrae.

ACTION.—Elevates the ribs, if the cervical vertebrae are the fixed point. It extends the neck, if the ribs are the fixed point. If only one acts it pulls the neck to its own side.

Transversalis colli (cervicis.)—**DESCRIPTION.**—This muscle takes its name from its attachment to the transverse processes, and its insertion in the neck.

ORIGIN.—From upper portion of transverse processes of six upper dorsal vertebrae.

INSERTION.—Posterior tubercles of transverse processes of the second to the sixth cervical vertebrae (inclusive.)

ACTION.—If both act, and the fixed point is below, they extend the neck backward.

Trachelo-mastoid.—**DESCRIPTION.**—This muscle takes its name from its origin and its insertion.

ORIGIN.—(1) Transverse processes of first five or six dorsal vertebrae, (2) articular processes of the three or four lower cervical vertebrae.

INSERTION.—Posterior margin of mastoid process of temporal bone be-

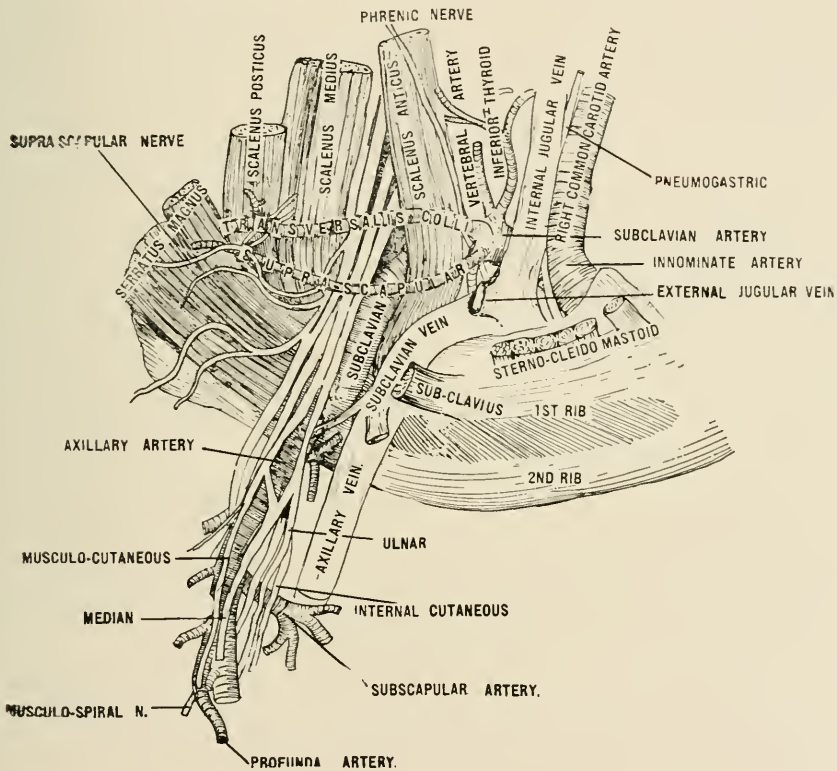
neath the insertion of the *Splenius capitis* and the *Sterno-cleido-mastoid*.

ACTION.—If both act, they extend the head backward. If only one acts it turns the face toward the shoulder of same side.

Complexus.—**DESCRIPTION.**—This muscle takes its name from the complicated arrangement of its muscular bundles.

ORIGIN.—Tips of transverse processes of from two to seven upper dorsal vertebrae and seventh cervical vertebrae. (2) articular processes of fourth, fifth, and sixth cervical vertebrae.

PLATE CXIV.



THYROID AXIS AND CORDS OF BRACHIAL PLEXUS.

INSERTION.—Into the innermost depression between the two curved lines of the occipital bone.

ACTION.—If both act they draw the head backward, if only one acts it draws the head to one side, and with the face turned to the opposite side.

Biventer cervicis.—**DESCRIPTION.**—This muscle is one of the so-called double bellied muscles, and is situated on the inner side of the *Complexus*.

ORIGIN.—Transverse processes of from two to four upper dorsal vertebrae.

INSERTION.—Superior curved line of the occipital bone.

ACTION.—This muscle is a helper to the *Complexus*.

Spinalis colli.—**DESCRIPTION.**—This muscle is small and connects the

spinous processes in the cervical region. This muscle is absent in about twenty per cent of the cases.

ORIGIN.—(1) Spinous processes of the fifth, sixth, and seventh cervical vertebrae, (2) and occasionally from the first and second dorsal vertebrae.

INSERTION.—Spine of axis and third and fourth cervical vertebrae.

ACTION.—To approximate the spines of the vertebrae.

LESSON LXXVII.

FIFTH LAYER OF MUSCLES OF BACK.

Semispinalis dorsi.—DESCRIPTION.—This muscle takes its name on account of its inner half being attached to the spine, and its situation in the dorsal region.

ORIGIN.—From transverse processes of fifth, sixth, seventh, eighth, ninth, and tenth dorsal vertebrae.

INSERTION.—Into the spinous processes of seventh and eighth cervical, first, second, third, and fourth dorsal vertebrae.

ACTION.—To erect the spinal column.

Semispinalis colli.—DESCRIPTION.—This muscle takes its name from the attachment of its one-half to the spines in the cervical region.

ORIGIN.—Transverse processes of the upper five or six dorsal vertebrae.

INSERTION.—Into the spinous processes of the second, third, fourth, and fifth cervical vertebrae.

ACTION.—To erect the spinal column.

Multifidus spinæ.—DESCRIPTION.—This muscle takes its name from its many clefts.

ORIGIN.—(1) Back of sacrum as far as the fourth sacral foramen, (2) aponeurosis of the Erector spinæ muscle, (3) Posterior superior spine of the ilium, (4) posterior sacro-iliac ligament, (5) articular processes of lumbar vertebrae, (6) transverse processes of dorsal vertebrae, (7) articular processes of three or four lower cervical vertebrae.

INSERTION.—Into the laminae and spinous processes of all the vertebrae except the atlas.

ACTION.—To preserve the erect position of the spine and to rotate it.

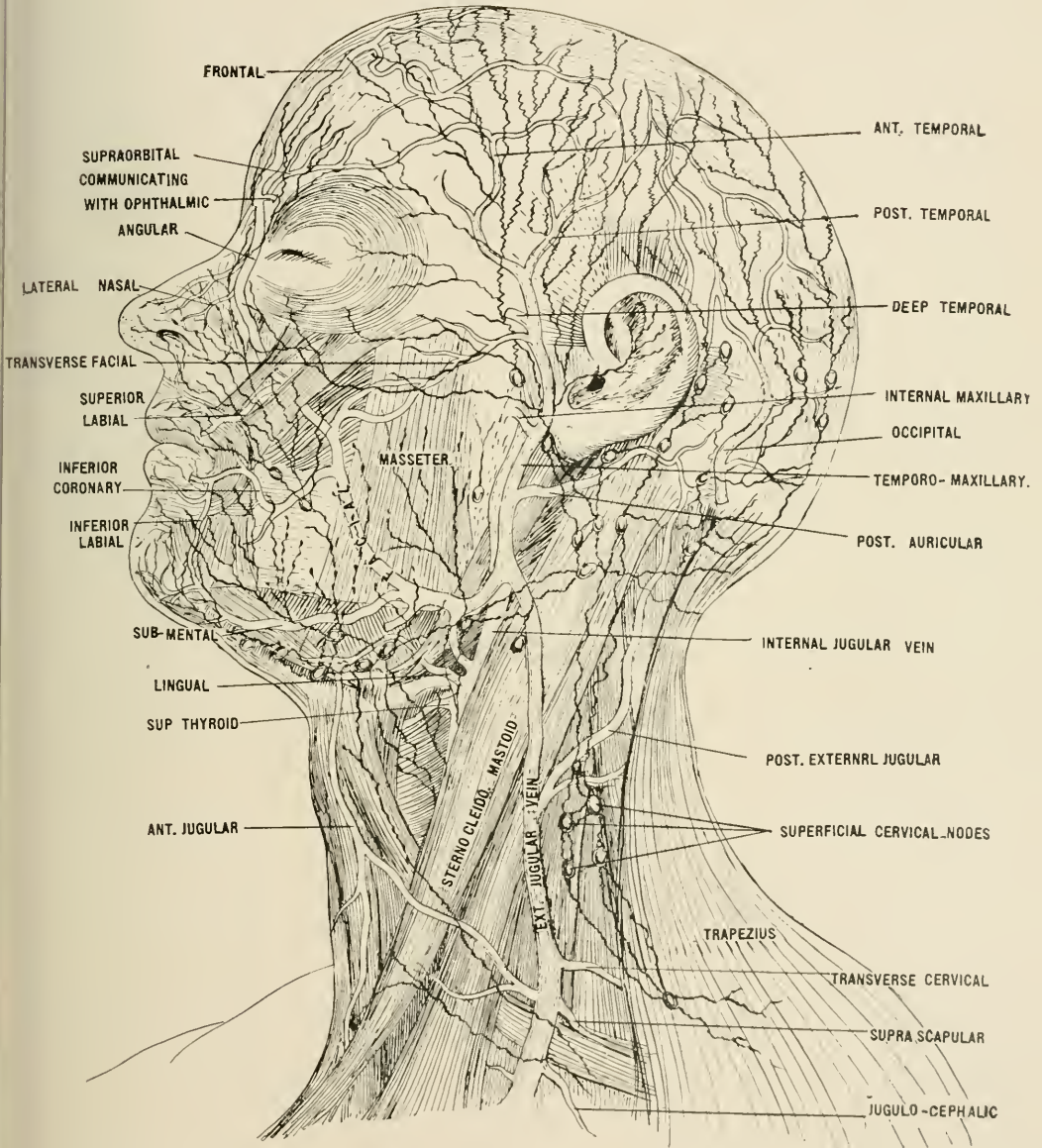
Rotatores spinæ.—DESCRIPTION.—This muscle takes its name from its functions. There are generally eleven pairs, but they may be found in the cervical and lumbar regions.

ORIGIN.—Upper and back parts of the transverse processes in the dorsal region of the spine.

INSERTION.—Lower border and outer surface of the first lamina above the origin.

ACTION.—Assists the Multifidus spinæ to rotate the spine, turning the trunk to the opposite side.

Supraspinales.—DESCRIPTION.—These muscles lie on the spinous processes in the cervical region.



LYMPHATICS AND VEINS OF NECK AND FACE.

ORIGIN.—Spinous process and external to the process immediately above.

INSERTION.—Spinous processes immediately above.

ACTION.—Approximate the spinous processes.

Interspinales.—**DESCRIPTION.**—These muscles are six pairs in the cervical region (first pair between axis and third cervical.) They are in the upper and lower dorsal, but absent in the middle dorsal. There are four pairs between the five lumbar vertebræ, sometimes one above and one below these pairs.

ORIGIN.—Spinous process below.

INSERTION.—Spinous process above.

ACTION.—Approximate the spinous processes.

Intertransversales.—**DESCRIPTION.**—In the cervical region these are best developed, and are in pairs (anterior and posterior) passing between the anterior and posterior tubercles of the transverse processes. Between these muscles pass the anterior division of the spinal nerve. There are seven pairs in the cervical region.

In the dorsal region they are not well developed. They are absent in the middle dorsal. In the lumbar region they are in pairs—one set called the *intertransversales laterales*, which are situated between the transverse processes. The other set called *intertransversales mediales* are situated between the accessory process of one vertebra and the mammillary process of the next.

ORIGIN.—In a transverse process below.

INSERTION.—Transverse process immediately above.

ACTION.—Approximate the transverse processes.

Extensor coccygis.—**DESCRIPTION.**—This muscle extends over the lower part of the posterior surface of sacrum and coccyx.

ORIGIN.—Last sacral or first coccygeal vertebra.

INSERTION.—Lower part of the coccyx.

ACTION.—To extend the coccyx.

Rectus capitis posticus major.—**DESCRIPTION.**—This muscle becomes broad as it ascends.

ORIGIN.—Spinous process of axis.

INSERTION.—Inferior curved line of the occipital bone and surface of bone below.

ACTION.—To rotate the cranium with atlas, around the odontoid process of the axis.

Rectus capitis posticus minor.—**DESCRIPTION.**—This muscle is the smallest of the muscles in this region.

ORIGIN.—Tubercle on posterior arch of atlas.

INSERTION.—Occipital bone beneath the inferior curved line.

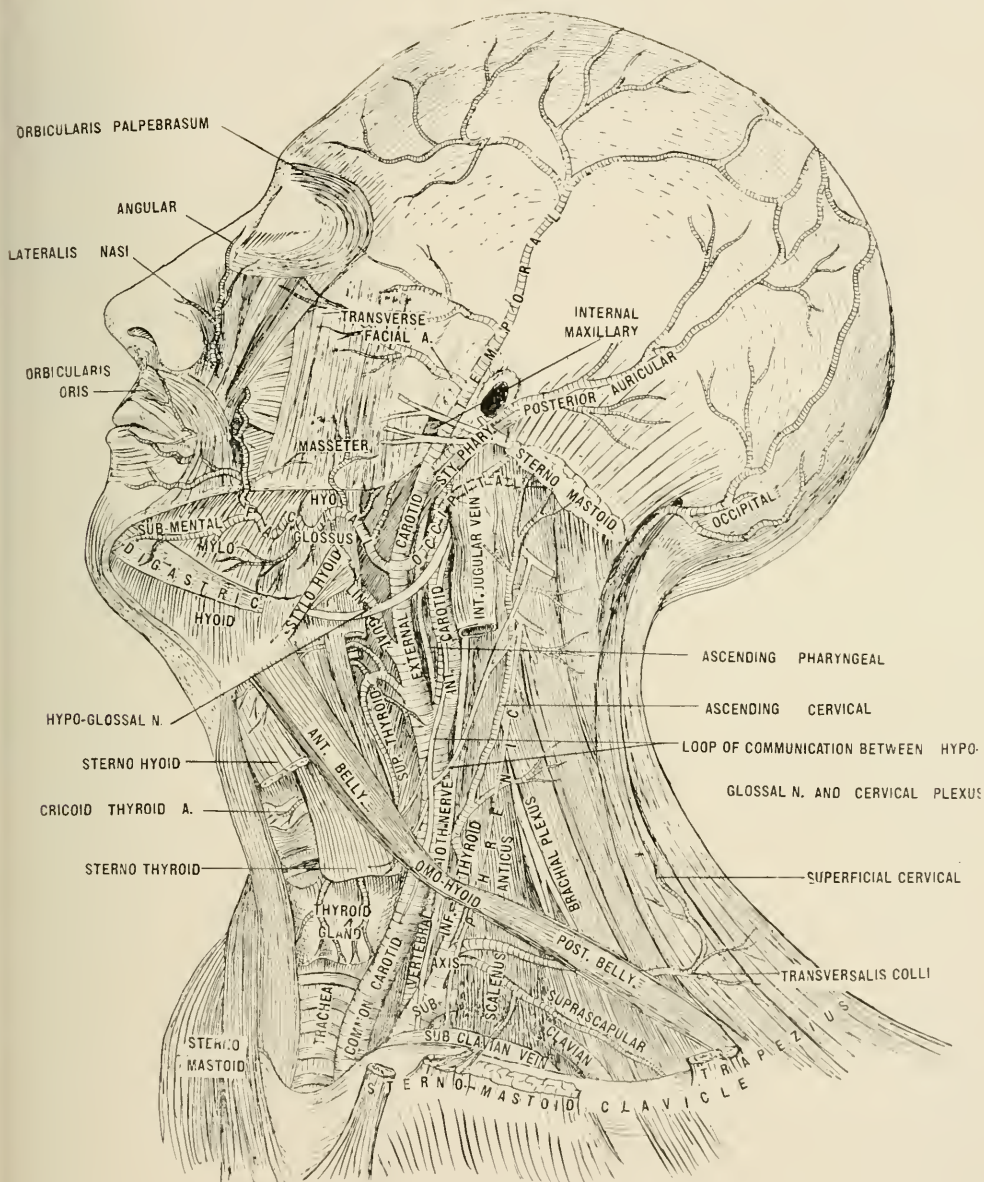
ACTION.—To draw the head backward.

Obliquus capitis superior.—**DESCRIPTION.**—This muscle is narrow below but wide above.

ORIGIN.—Upper surface of transverse process of atlas.

INSERTION.—Occipital bone between the superior and inferior curved lines external to the Complexus.

ACTION.—To draw the head backward and rotate cranium.



THE EXTERNAL CAROTID ARTERY.

Obliquus capitis inferior.—DESCRIPTION.—This muscle is larger than the superior one.

ORIGIN.—Apex of axis.

INSERTION.—Lower and back part of transverse process of atlas.

ACTION.—To rotate the atlas with cranium.

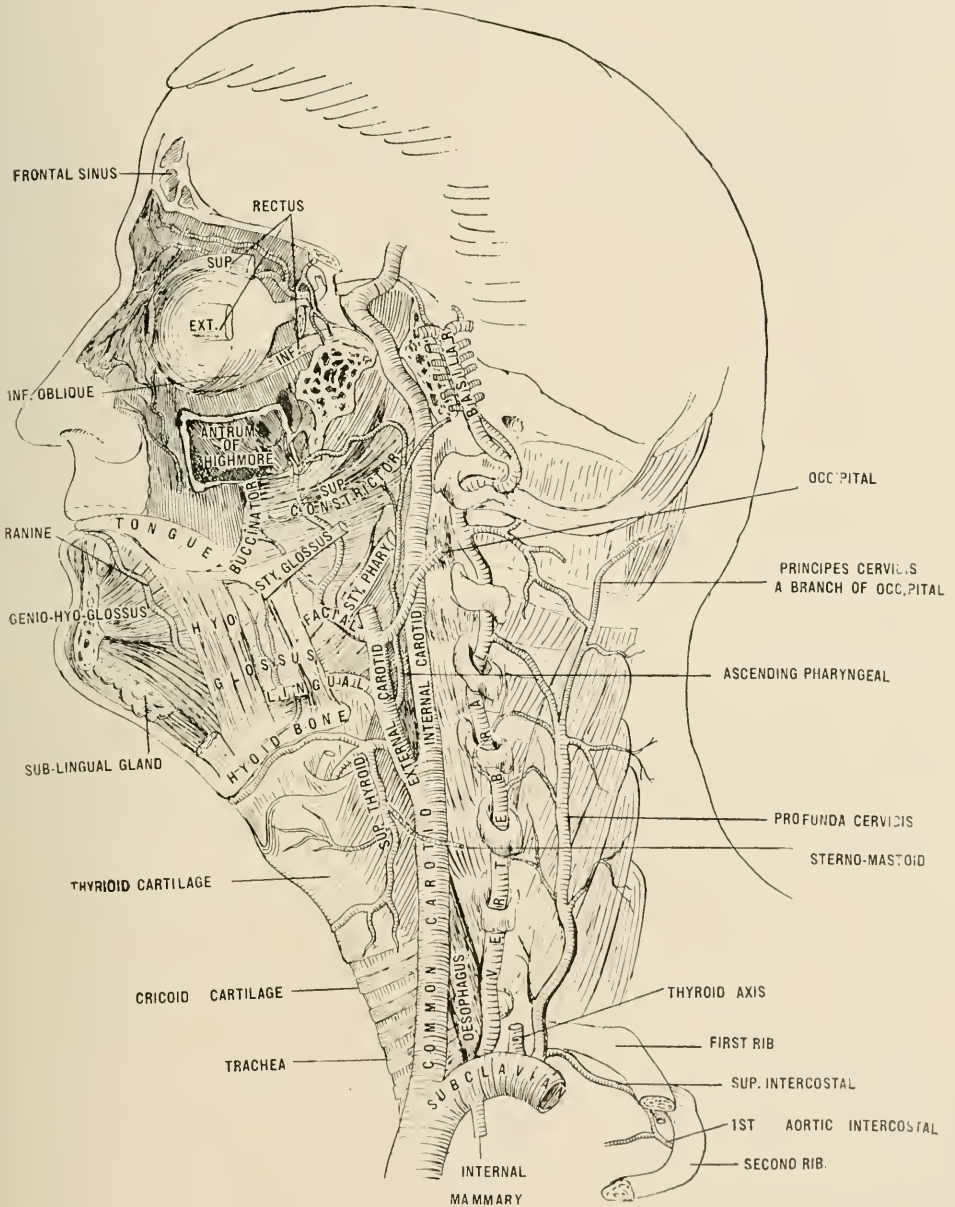
The **skin of the back** is supplied by posterior divisions of spinal nerves. The internal branch of the posterior divisions of the upper six dorsal nerves are cutaneous, while the external branches of the posterior divisions of the lower six dorsal nerves are cutaneous. The external divisions of the upper and the internal divisions of the lower six have no cutaneous distribution.

The **sacro-vertebral articulation** is supplied by the fourth and fifth lumbar and sympathetic nerves. The **costo-central articulations** are supplied by the anterior divisions of the spinal nerves. The **costo-transverse articulations** are supplied by the posterior divisions of the spinal nerves. The **sacro-iliac articulations** are supplied by the posterior divisions of the first and second sacral nerves, the superior gluteal nerve, and sacral plexus. The **sacro-coccygeal articulation** is supplied by the fourth and fifth sacral and coccygeal nerves. The **ribs** and **vertebræ** are supplied by the gray rami communicantes.

LESSON LXXVIII.

TRIANGLES OF THE NECK. (Plate XIV.)

The **side of the neck** is in the form of a rectangle, bounded, above by the lower margin of the jaw-bone and a line continued from the angle of the jaw to the mastoid process; below, by the clavicle; posteriorly, by the Trapezius; and anteriorly by the median line of the neck. This rectangle is divided into two triangles by the Sterno-cleido-mastoid. The anterior one is bounded in front by an imaginary line, behind by the Sterno-cleido-mastoid, and above by the lower jaw-bone. The posterior one is bounded in front by the Sterno-cleido-mastoid, behind by the Trapezius, and below by the clavicle. The Omo-hyoid divides these triangles into two others and the Digastric divides the upper one of the anterior triangles into two other triangles. The Digastric pierces the Stylo-hyoid which helps to make the boundary line of the sub-maxillary triangle. Then these muscles divide the rectangle on the side of the neck into five triangles. (1) THE INFERIOR CAROTID TRIANGLE, OR TRIANGLE OF NECESSITY, OR MUSCULAR TRIANGLE. (2) THE SUPERIOR CAROTID TRIANGLE, OR TRIANGLE OF ELECTION. (3) THE SUBMAXILLARY, OR DIGASTRIC TRIANGLE. (4) THE OCCIPITAL TRIANGLE. (5) THE SUBCLAVIAN, OR SUPRACLAVICULAR TRIANGLE. All these five triangles have a roof, boundary lines, and contents. The roof of them is made by skin, superficial fascia, Platysma myoides, and deep fascia. The **inferior carotid triangle** in addition to this has the superficial cervical nerve ramifying in its roof. Right beneath this roof are the Sterno-hyoid and Sterno-thyroid. By some these two muscles are called the floor, but the Longus colli and Scalenus anticus and part of the Rectus capitis anticus major form the floor. This triangle is bounded in front by the median line, ABOVE by the anterior



THE INTERNAL CAROTID ARTERY.

belly of the Omo-hyoid, and **BELOW** by the inferior part of the Sterno-cleido-mastoid. Just beneath the anterior border of the Sterno-cleido-mastoid is the **common carotid sheath** which is described in connection with this triangle, although it is under this muscle. This **sheath** contains the common carotid artery internally, the internal jugular vein externally, and the pneumogastric nerve between the two but on a plane posterior to them. This sheath is bounded **IN FRONT** by branches from the loop of communication; **ON THE INNER SIDE** by the trachea, thyroid gland, and the lower part of the larynx; **BEHIND** by the inferior thyroid artery, recurrent laryngeal nerve and the sympathetic nerve.

The **second triangle, superior carotid, or triangle of election**, is bounded **BELOW** by the anterior belly of the Omo-hyoid; **BEHIND** by the Sterno-cleido-mastoid; **ABOVE** by the Digastric. Its roof is made of skin, superficial fascia, Platysma myoides, and deep fascia. Its floor is made of four muscles, Thyro-hyoid, Hyo-glossus, Inferior constrictor, and Middle constrictor. The external carotid artery has eight branches, five of which are in this triangle, viz., superior thyroid, lingual, facial, ascending pharyngeal, and occipital, with their corresponding veins, all of which empty into the internal jugular, except the occipital which may empty into the external jugular.

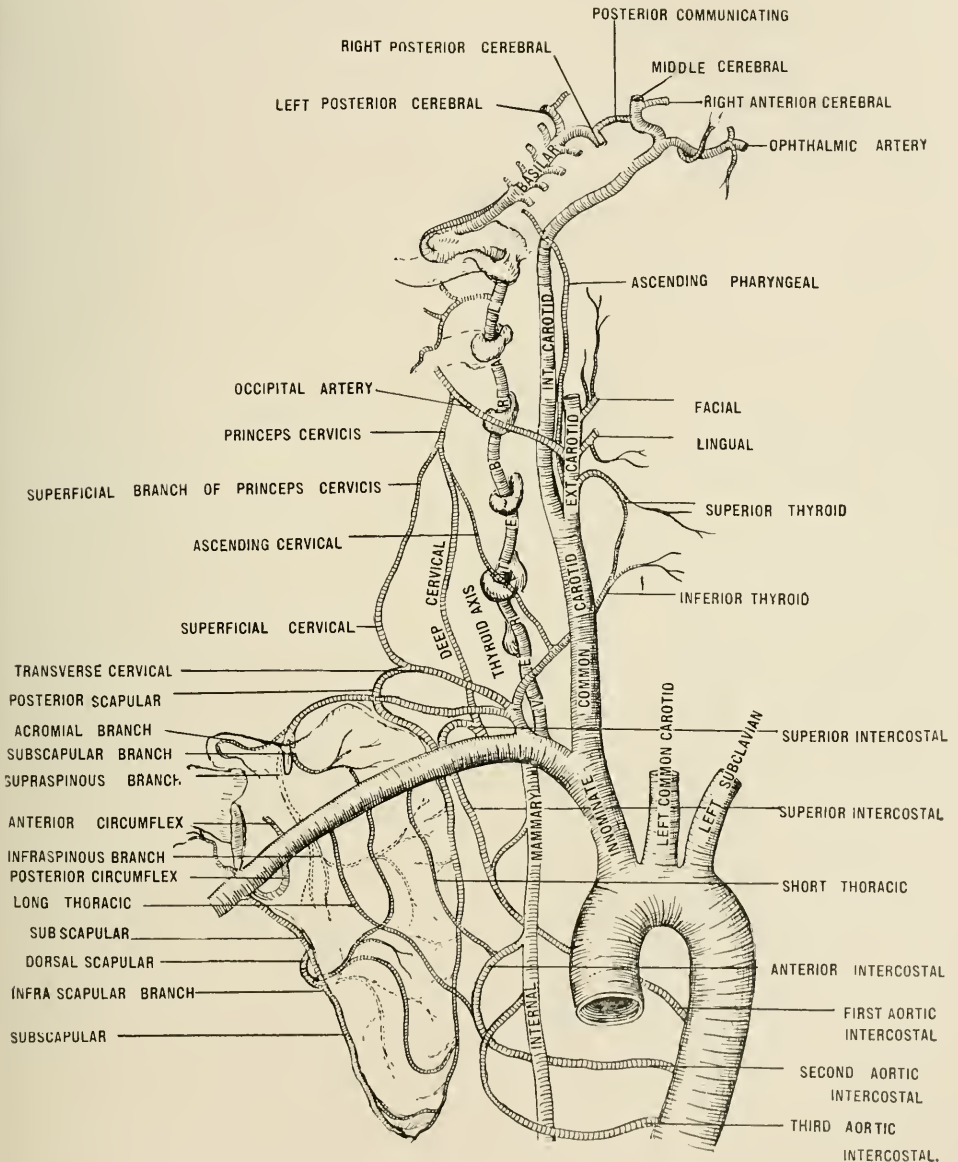
The **third triangle, or digastric, or submaxillary triangle**, is bounded **IN FRONT** by the anterior belly of the Digastric; **BEHIND** by the Style-hyoid perforated by the posterior belly of the Digastric; and **ABOVE** by the mandible and a line drawn from the angle of the jaw to the mastoid process. Its roof is made of the skin, superficial fascia, Platysma myoides, deep fascia, with the seventh nerve ramifying in it. Its floor is formed by the Mylo-hyoid and Hyo-glossus. This triangle is divided into two other triangles by the Style-maxillary ligament, the anterior one of which contains the submaxillary gland and the posterior one contains the parotid gland.

The **occipital triangle** is bounded **IN FRONT** by the Sterno-cleido-mastoid, **BELOW** by the posterior belly of the Omo-hyoid, and **BEHIND** by the Trapezius. Its roof is made of the skin, superficial fascia, Platysma myoides, and deep fascia. Its floor from above downward and inward is formed by the Splenius capitis, Levator anguli scapulae, Scalenus posticus and Scalenus medius. The spinal accessory nerve crosses this triangle from the Sterno-cleido-mastoid to the Trapezius. A row of lymphatic nodes lie along the posterior border of the Sterno-cleido-mastoid in this triangle.

The **subclavian or supraclavicular triangle** is bounded **ABOVE** by the posterior belly of the Omo-hyoid, **IN FRONT** by the Sterno-cleido-mastoid, and **BELOW** by the clavicle. Its roof is made by the skin, superficial fascia, Platysma myoides, and deep fascia and has the suprascapular vessels and nerve lying in it. Its floor is made of the digitations of the Serratus magnus, Scalenus posticus, Scalenus medius, and part of the first rib. It has a few lymphatic glands in it.

THE SUBOCCIPITAL TRIANGLE. (Plate CXI.)

The **suboccipital triangle** is bounded **EXTERNALLY** by the Superior oblique; **BELOW** by the Inferior oblique, and **INTERNALLY** by the Rectus capitis posticus major. The floor of this triangle is formed by the posterior occipito-atlantal



THE ARTERIES FROM ARCH OF AORTA TO CIRCLE OF WILLIS.

ligament and the posterior arch of the atlas, and its roof is made by the Complexus muscle. The vertebral artery lies in a groove on the upper surface of the posterior arch of the atlas in this triangle. The suboccipital nerve enters this triangle between the vertebral artery and the arch of the atlas. The deep cervical vein begins in this triangle.

LESSON LXXIX.

ARTERIES.

The **pulmonary artery** (Plate CXXVIII) arises from the left side of the base of the right ventricle in front of the aorta. It passes upward and backward, being to the left side and in front of the ascending aorta. It is about two inches long and ends under the transverse aorta where it divides into the right pulmonary artery and the left pulmonary artery. This artery and the ascending aorta are enclosed in a common prolongation of the serous pericardium. The **right pulmonary artery**, which is larger and longer than the left, passes behind the ascending aorta and the superior vena cava where it pierces the pericardium. It divides into the branches at the root of the lung, one branch being for the upper lobe of the right lung and the other for the lower lobe. The branch which passes to the middle lobe is derived from the upper branch.

The **left pulmonary artery** passes in front of the descending aorta and the left bronchus to end in the root of the left lung where it divides into an upper branch for the upper lobe and a lower branch for the lower lobe.

The remains of the ductus arteriosus passes from the left pulmonary artery to the inferior surface of the transverse aorta.

The **aorta** begins at the upper part of the left ventricle and passes upward to the right, it then arches to the left and backward. It now descends on the left side of the vertebral column to pass through the aortic opening of the Diaphragm and it ends opposite the fourth lumbar vertebra where it divides into a right and left common iliac artery. The aorta has the following divisions: (1) **Ascending**, (2) **Transverse**, (3) **Descending**, and this descending portion is divided into thoracic and abdominal. The part above the Diaphragm is the thoracic aorta and the part below the Diaphragm is the abdominal aorta. The ascending portion commences behind the left half of the sternum at the level of the lower border of the third costal cartilage. It passes obliquely upward and forward to the right where it ends at the upper border of the second right chondro-sternal articulation. It is about two inches in length.

The Relations of the Ascending Aorta are:

IN FRONT.—(1) Pulmonary artery, (2) Right auricular appendix, (3) Pericardium, (4) Right pleura and lung, (5) Remains of thymus gland.

BEHIND.—(1) Right pulmonary artery, (2) Left auricle.

RIGHT SIDE.—(1) Superior vena cava, (2) Right auricle.

LEFT SIDE.—Pulmonary artery.

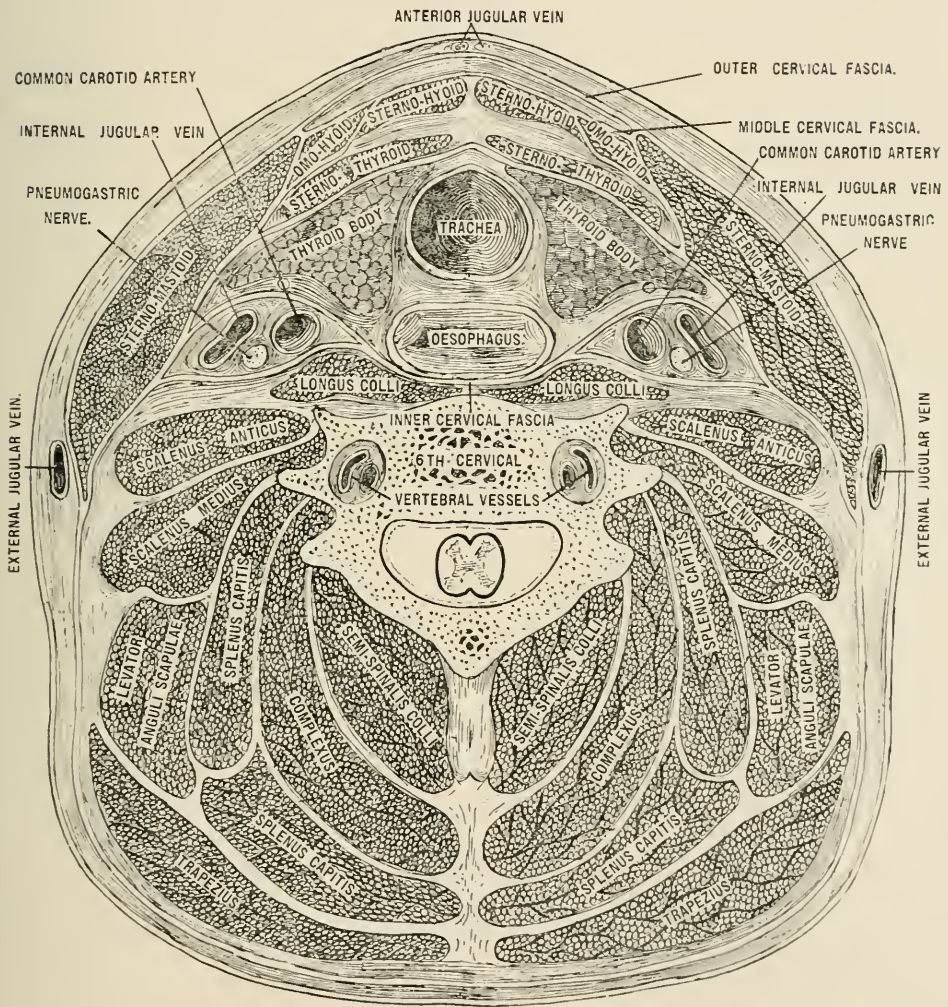
The **Transverse aorta** (arch) (Plate CXXVIII) is a continuation of the ascending aorta from the upper border of the second right chondro-sternal articulation. It arches to the left and backward with its convexity upward

and ends at the left side of the lower border of the fourth dorsal vertebra from which place it is called thoracic aorta. The upper border of the arch is about an inch below the upper margin of the sternum.

Relations of the Arch of the Aorta.

ABOVE.—(1) Left innominate vein, (2) Innominate artery, (3) Left carotid artery, (4) Left subclavian artery.

PLATE CXIX.



THE CERVICAL FASCIA.

BELOW.—(1) Bifurcation of pulmonary artery, (2) Remains of ductus arteriosus, (3) Superficial cardiac plexus, (4) Left recurrent laryngeal nerve, and (5) Left bronchus.

IN FRONT.—(1) Pleurae and lungs, (2) Remains of thymus gland, (3) Left,

pneumogastric nerve, (4) Left phrenic nerve, (5) Superficial cardiac nerves (6) Left superior intercostal vein.

BEHIND.—(1) Trachea, (2) Deep cardiac plexus, (3) Oesophagus, (4) Thoracic duct, (5) Left recurrent laryngeal nerve.

The Relations of the Thoracic Aorta are: (Plate CXXVIII.)

IN FRONT.—(1) Root of left lung, (2) Pericardium, (3) Oesophagus, (4) Diaphragm.

BEHIND.—(1) Vertebral column, (2) Superior and inferior azygos minor veins.

RIGHT SIDE.—(1) Oesophagus (above), (2) Vena azygos major, (3) Thoracic duct.

LEFT SIDE.—(1) Pleura, (2) Left lung, (3) Oesophagus (below.)

The ascending aorta has the right coronary and the left coronary artery which have been described with the heart. The branches of the arch of the aorta are (1) innominate, (2) left common carotid, (3) left subclavian. The branches of the thoracic aorta are (1) pericardiac, (2) bronchial, (3) oesophageal, (4) posterior mediastinal, (5) intercostal.

LESSON LXXX.

The **innominate artery** often called **brachio-cephalic** has its beginning opposite the fourth dorsal vertebra just in front of the left common carotid. It is the largest of the branches of the arch of the aorta. At the upper border of the right sterno-clavicular articulation it divides into the right common carotid and the right subclavian. It is from an inch and a half to two inches long and has no branches as a rule, but the thyroidea ima may arise from it.

The Relations of the innominate artery are as follows;

IN FRONT.—(1) Sternum, (2) Sterno-hyoid and (3) Sterno-thyroid muscles, (4) Remains of the thymus gland, (5) Left innominate vein, (6) Right inferior thyroid vein, (7) Inferior cervical cardiac branch from right pneumogastric nerve.

BEHIND.—Trachea.

RIGHT SIDE.—(1) Right innominate vein, (2) Right pneumogastric nerve. (3) Pleura.

LEFT SIDE.—(1) Remains of thymus gland, (2) Left carotid artery, (3) Left inferior thyroid vein, (4) Trachea.

The **right common carotid artery** (Plates CXVI-CXVII) arises from the innominate at the upper border of the right sterno-clavicular articulation. It passes obliquely upward and divides into the external carotid and internal carotid at the upper border of the thyroid cartilage opposite the fourth cervical vertebra.

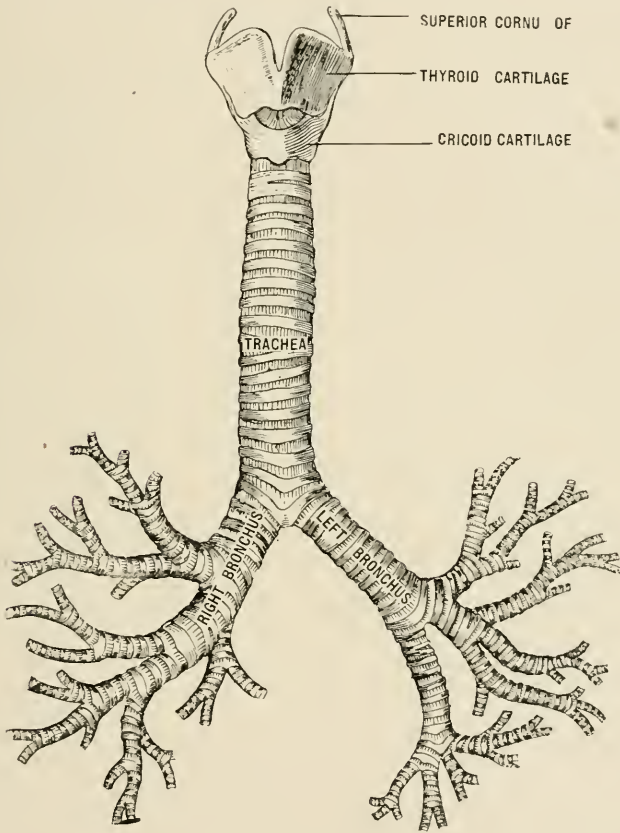
The **left common carotid artery** comes from the highest part of the arch of the aorta and passes upward behind the left sterno-clavicular articulation to divide into the external carotid and internal carotid at the upper border of the thyroid cartilage opposite the fourth cervical vertebra. These arteries are enclosed in a common sheath of cervical fascia with the internal jugular vein

and pneumogastric nerve. The internal jugular vein lies external to the artery while the pneumogastric nerve is between the internal jugular vein and common carotid artery but on a plane posterior to them. Occasionally a thyroid branch passes from this artery.

The Relations of the Left Common Carotid Artery in the thorax is as follows:

IN FRONT.—(1) Sternum, (2) Sterno-hyoid and (3) Sterno-thyroid muscles.

PLATE CXX.



THE TRACHEA.

(4) Left innominate vein, (5) Remains of thymus gland.

BEHIND.—(1) Trachea, (2) Oesophagus, (3) Thoracic duct, (4) Left subclavian artery.

INTERNALLY.—(1) Innominate artery, (2) Inferior thyroid veins, (3) Remains of thymus gland.

EXTERNALLY.—(1) Left pneumogastric nerve, (2) Left pleura, (3) Left lung, (4) Left subclavian artery.

LESSON LXXXI

The Relations of the Right Common Carotid and the Left Common Carotid arteries (in the neck).

IN FRONT.—(1) Integument, (2) Superficial fascia, (3) Deep cervical fascia, (4) Platysma myoides, (5) Sterno-mastoid, (6) Sterno-hyoid, (7) Sterno-thyroid, (8) Omo-hyoid, (9) Descendens and Communicans nerves, (10) Sterno-mastoid artery, (11) Superior thyroid vein, (12) Middle thyroid vein, (13) Anterior jugular vein.

BEHIND.—(1) Longus colli, (2) Rectus capitis anticus major, (3) Sympathetic nerve, (4) Inferior thyroid artery, (5) Recurrent laryngeal nerve.

EXTERNALLY.—(1) Internal jugular vein, (2) Pneumogastric nerve.

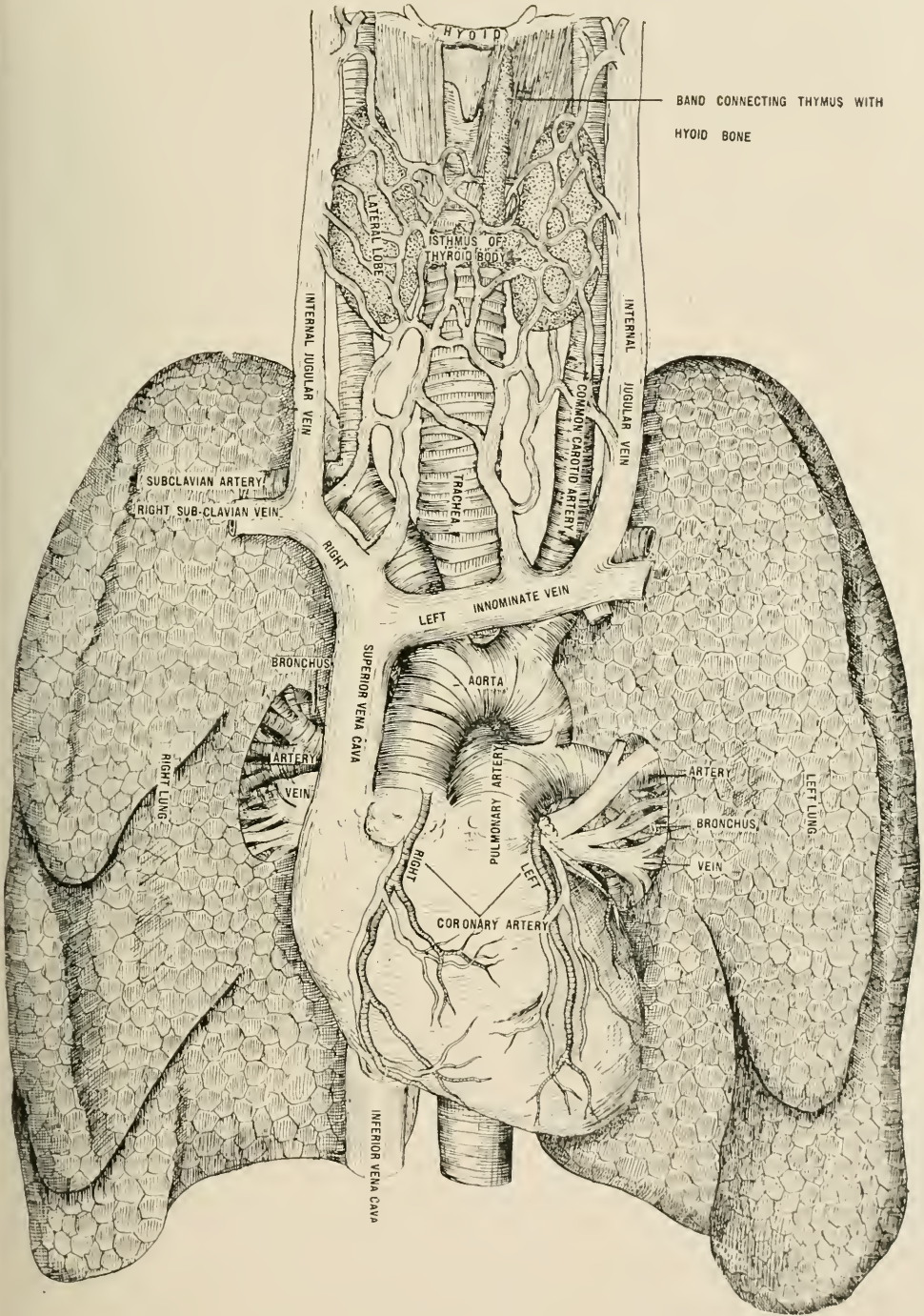
INTERNALLY.—(1) Trachea, (2) Thyroid gland, (3) Recurrent laryngeal nerve, (4) Inferior thyroid artery, (5) Larynx, (6) Pharynx.

The **common carotid arteries** at the root of the neck are close together and deeply situated, but higher in the neck they become separated and are more superficial. The common carotid artery, internal jugular vein and the pneumogastric nerve all lie in a common sheath.

The **external carotid artery** is a branch from the common carotid artery at the upper border of the thyroid cartilage, from which place it runs upward and forward, then backward between the external auditory meatus and the neck of the condyle of the mandible (lower jaw). It now divides into a superficial temporal and internal maxillary arteries. It lies in the superior carotid triangle (triangle of clefion) and passes through the substance of the parotid gland. It is superficial to and nearer to the median line of the neck than the internal carotid artery at its beginning. The branches of the external carotid artery are, (1) superior thyroid, (2) lingual, (3) facial, which are anterior branches; (4) occipital, (5) posterior auricular, which are posterior branches; (6) ascending pharyngeal, which is an ascending branch; (7) superficial temporal, (8) internal maxillary, which are terminal branches.

LESSON LXXXII.

The **superior thyroid branch** (Plate CXVI.) arises just below the great cornu of the hyoid bone, and passes inward and upward across the superior carotid triangle from which place it passes downward and forward to the upper part of the thyroid gland, after passing under the Sterno-hyoid, Sterno-thyroid and Omo-hyoid muscles. Besides giving branches to these muscles and the thyroid gland, it gives off (1) a **HYOID BRANCH** which passes along the lower border of the hyoid bone, (2) **STERNO-MASTOID BRANCH**, also called **SUPERFICIAL DESCENDING**, which passes to the Sterno-mastoid muscle after running downward and outward across the sheath of the common carotid artery. (3) **SUPERIOR LARYNGEAL**, which passes with the superior laryngeal nerve to the

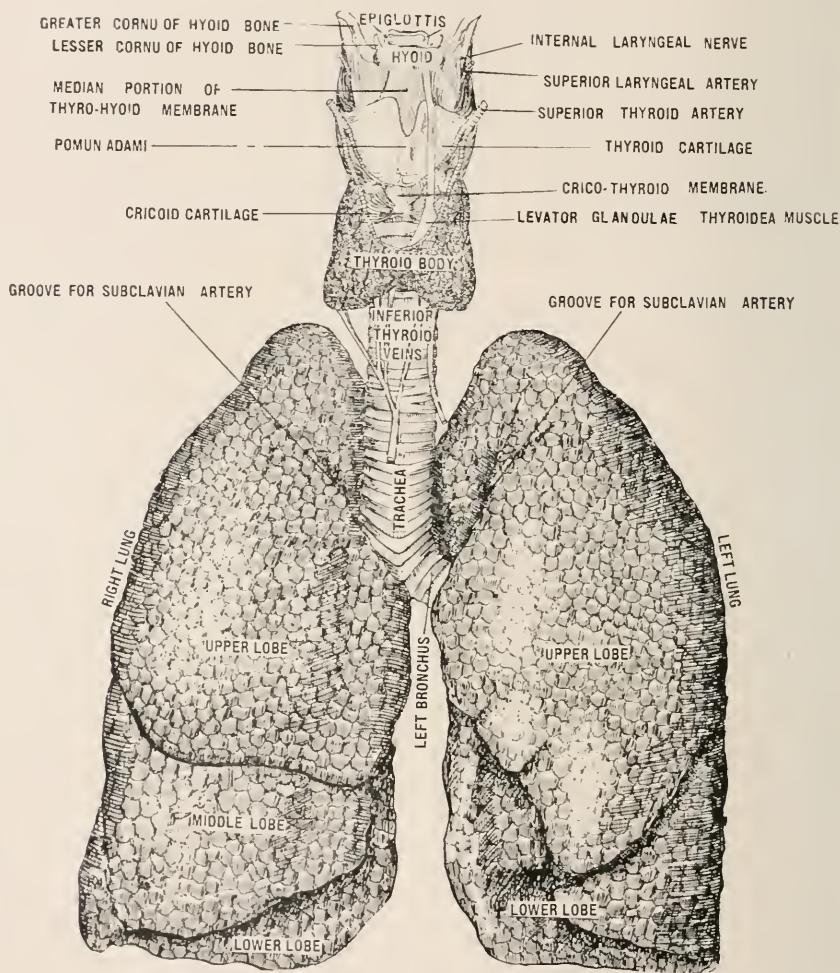


THE HEART, THYROID GLAND (AND LUNGS TURNED OUTWARD).

larynx under the Thyro-hyoid muscle. (4) CRICO-THYROID BRANCH which runs across the crico-thyroid membrane.

The **lingual artery** (Plate CXVI.) first passes obliquely upward and inward across the Middle constrictor muscle to the greater cornu of the hyoid bone. It now passes horizontally forward on the Middle constrictor muscle

PLATE CXXII.



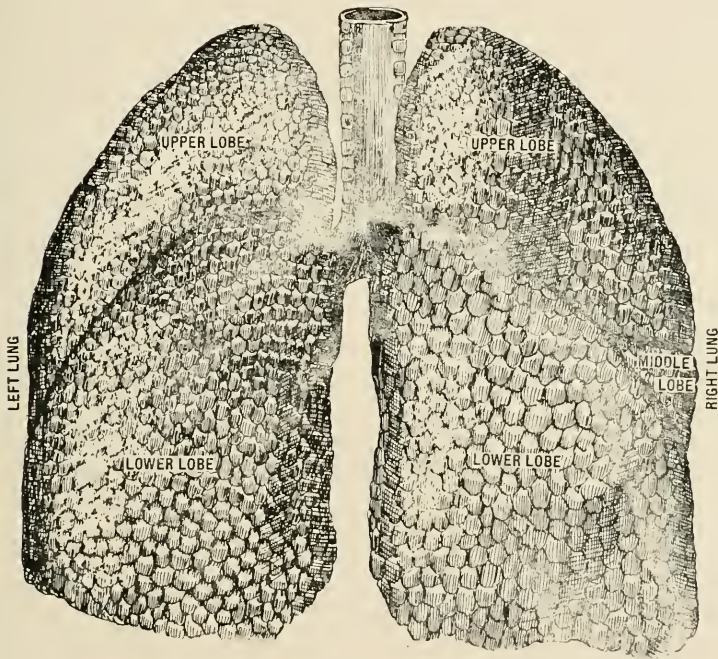
ANTERIOR VIEW OF LUNGS.

under the tendon of the Digastric muscle, Stylo-hyoid and the Hyo-glossus muscle. The Hyo-glossus muscle separates the lingual artery and the twelfth cranial nerve (hypoglossal). The artery now passes vertically upward between the Hyo-glossus and Genio-hyo-glossus to the under surface of the tongue where it takes the name of ranine artery. In this position it accompanies the lingual nerve, lying on or internal to the Lingualis muscle. It gives off (1) A HYOID

BRANCH, which runs along the upper border of the hyoid bone, (2) DORSALIS LINGUÆ BRANCH, which passes upward under the Hyo-glossus muscle to the dorsum of the tongue, (3) A SUBLINGUAL BRANCH, which passes on the Genio-hyo-glossus muscle to the sublingual gland, (4) THE RANINE BRANCH.

The **fascial artery** (Plate CXVI.) comes from the external carotid just above the origin of the lingual artery and passes obliquely upward under the Digastric and Stylo-hyoid muscles, it then passes forward in a groove on the posterior surface of the submaxillary gland. This much of the artery is called the cervical portion. It then passes upward over the lower jaw at the anterior margin of the Masseter muscle to the angle of the mouth. This portion of the artery is called the facial portion. It now runs upward along the nose and ends at the

PLATE CXXIII.



POSTERIOR VIEW OF LUNGS.

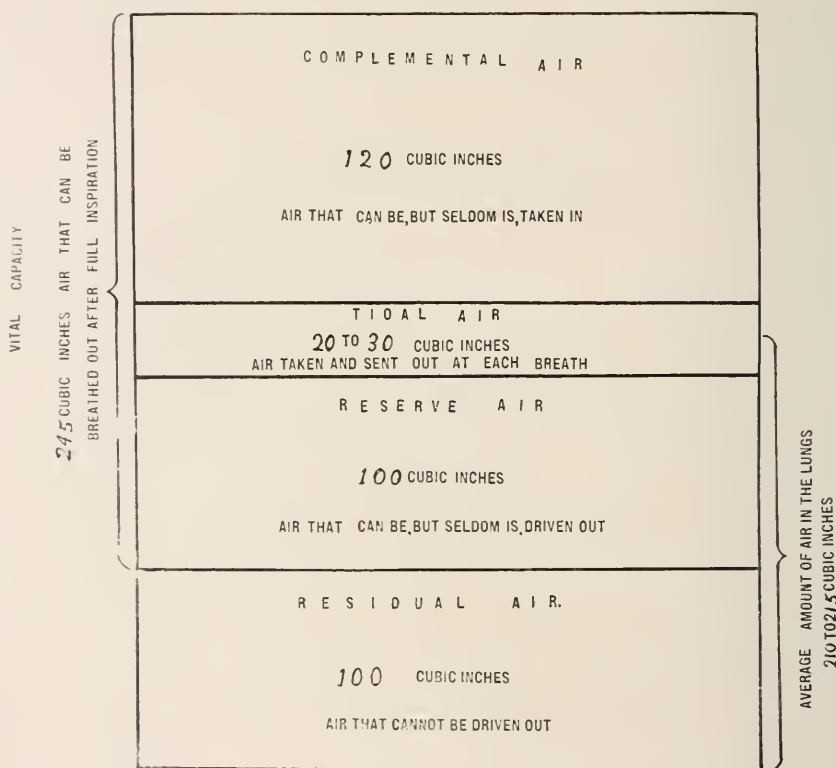
inner canthus of the eye. This portion of the artery is called angular portion. The facial artery lies just under the superficial muscles and has a very tortuous course.

The branches of the facial artery given off in the neck are (1) INFERIOR OR ASCENDING PALATINE, which passes between the Stylo-glossus and Stylo-pharyngeus muscles to the outer side of the pharynx where it divides into two branches, one of which runs through the Superior constrictor muscle and the other branch passes over this muscle. (2) THE TONSILLAR BRANCH which passes between the Internal pterygoid and Stylo-glossus muscles and after piercing the Superior constrictor passes to the tonsil. (3) THE SUBMAXILLARY

BRANCHES, which are three or four in number, pass to the submaxillary gland. (4) THE SUBMENTAL BRANCH, which runs forward on the Mylo-hyoid muscle and under the Digastric muscle to the symphysis where it divides into a superficial and deep branch which pass over and under the Depressor labii inferioris muscle to the lip. (5) MUSCULAR BRANCHES which pass to the adjacent muscles.

The branches of the facial artery given off on the face are, (1) INFERIOR LABIAL which runs under the Depressor anguli oris muscle to the lower lip, (2) INFERIOR CORONARY which runs in a very tortuous course along the edge of

PLATE CXXIV.



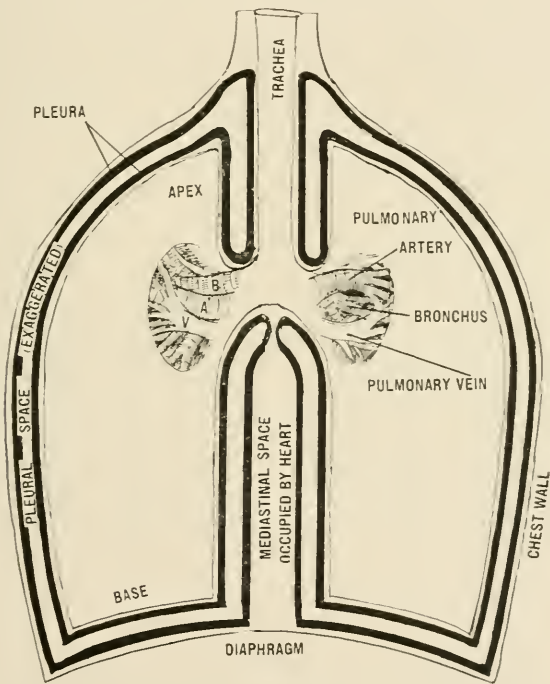
SHOWING THE CAPACITY OF THE LUNGS.

the lower lip, (3) SUPERIOR CORONARY, which is larger and more tortuous even than the inferior coronary, runs along the edge of the upper lip and gives branches (a) to the nose, (b) the inferior artery of the septum, and (c) the artery of the ala. (4) Lateralis nasi which passes to the ala and dorsum of the nose. (5) ANGULAR which passes to the inner angle of the orbit, (6) muscular which pass to the adjacent muscles.

LESSON LXXXIII.

The **occipital artery** (Plate CXVI) is a branch from the external carotid opposite the facial artery and it passes under the Stylo-hyoid muscle and the posterior belly of the Digastric muscle. The twelfth cranial nerve (hypoglossal) winds around it. This artery passes upward across the spinal accessory nerve and the internal carotid sheath to the space between the mastoid process of the temporal bone and the transverse process of the atlas. It now runs backward in the occipital groove on the mastoid process and pierces the origin of the Trapezius muscle and passes upward in a tortuous course to the

PLATE CXXV.



SHOWING PLEURE AND ROOT OF THE LUNGS.

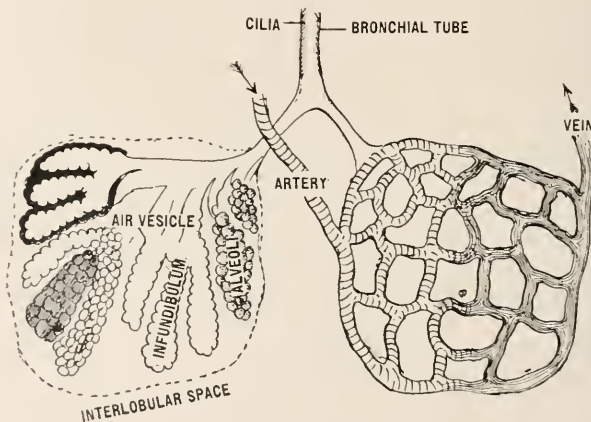
vertex, being accompanied by the great occipital nerve in the last part of its course, while the Complexus muscle separates the artery and nerve at the beginning. Its branches are, (1) **STERNO-MASTOID**, which passes over the hypoglossal nerve to the Sterno-cleido-mastoid muscle, (2) **AURICULAR**, which passes to the back of the concha, and it may send a branch through the mastoid foramen to the dura mater, (3) **MENINGEAL**, which passes through the jugular foramen to the dura mater, (4) **ARTERIA PRINCEPS CERVICIS**, which descends along the back of the neck and divides into two branches, (a) the superficial one which passes under the Splenius to anastomose with the superficial cervical from the transversalis colli, (b) the deep branch runs under the Complexus

muscle to anastomose with the deep cervical from the superior intercostal. (5) **MUSCULAR BRANCHES** to the adjacent muscles.

The **posterior auricular artery** (Plate CXVI.) is a branch of the external carotid which arises opposite the apex of the styloid process of the temporal bone and passes between the facial nerve and spinal accessory nerve under the parotid gland into the groove between the mastoid process of the temporal bone and the cartilages of the ear where it divides into auricular and mastoid branches. Its branches are (1) **MUSCULAR**, (2) **GLANDULAR** (parotid), (3) **STYLO-MASTOID** which passes through the stylo-mastoid foramen to (a) the tympanum, (b) mastoid cells, (c) semicircular canals, and it anastomoses with the tympanic branch of the internal maxillary and the petrosal branch of the middle meningeal, (4) **AURICULAR BRANCH** to back of the ear, (5) **MASTOID** to the scalp above and behind the ear.

The **ascending pharyngeal branch** (Plate CXVI.) is the smallest and most deeply seated of the branches of the external carotid and arises from near the beginning of the artery (sometimes from the internal carotid). It passes up-

PLATE CXXVI.



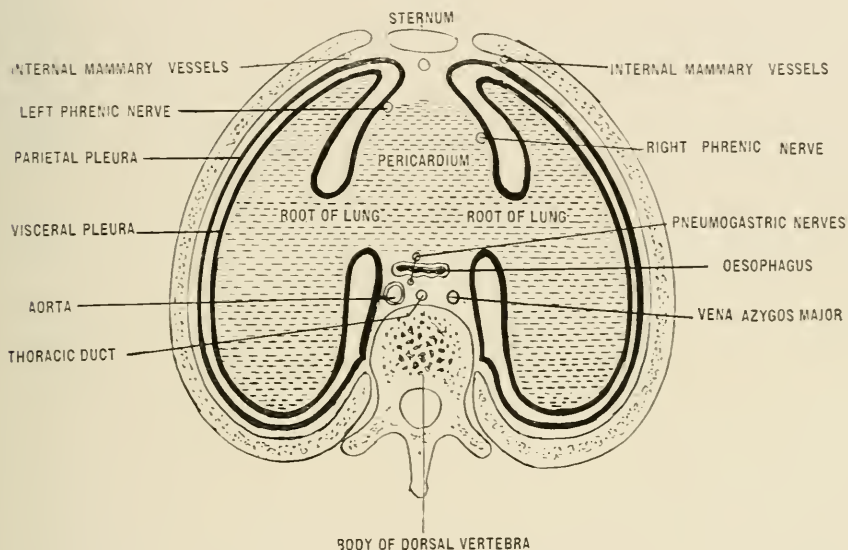
AIR CELLS OF THE LUNGS.

ward to the base of the skull on the Rectus capitis anticus major between the pharynx and the internal carotid artery. Its branches are (1) **PREVERTEBRAL**, which passes to the structures on the front of the spine, (2) **PHARYNGEAL**, which pass to the Constrictor muscles and one of its branches passes along the Eustachian tube to the tympanum. (3) **MENINGEAL BRANCHES** which pass to the dura mater through (a) middle lacerated foramen, (b) posterior lacerated foramen, (c) anterior condyloid foramen.

The **superficial temporal branch** arises from the external carotid in the parotid gland and passes upward over the posterior root of the zygoma above which it divides into the anterior temporal and posterior temporal. Its branches are (1) **SMALL ONES** to the parotid gland, (2) **ARTICULAR ONES** to the lower jaw, (3) **MUSCULAR ONES** to the muscles, (4) **ANTERIOR TEMPORAL** which runs forward to structures on the frontal bone, (5) **POSTERIOR TEMPORAL** which

runs upward and backward to structures on the side of the parietal bone, (6) **TRANSVERSE FACIAL BRANCH** which crosses the Masseter muscle and passes between the zygoma and the duct of the parotid gland (Stenson's) to the side of the face, (7) **MIDDLE TEMPORAL** which passes just below the zygoma through the temporal fascia to the muscle, and sometimes it sends an orbital branch along the upper border of the zygoma. (8) **AN AURICULAR BRANCH** which passes to the external meatus and the front of the ear.

PLATE CXXVII.



A TRANSVERSE SECTION OF THE PLEURÆ THROUGH ROOT OF LUNGS.

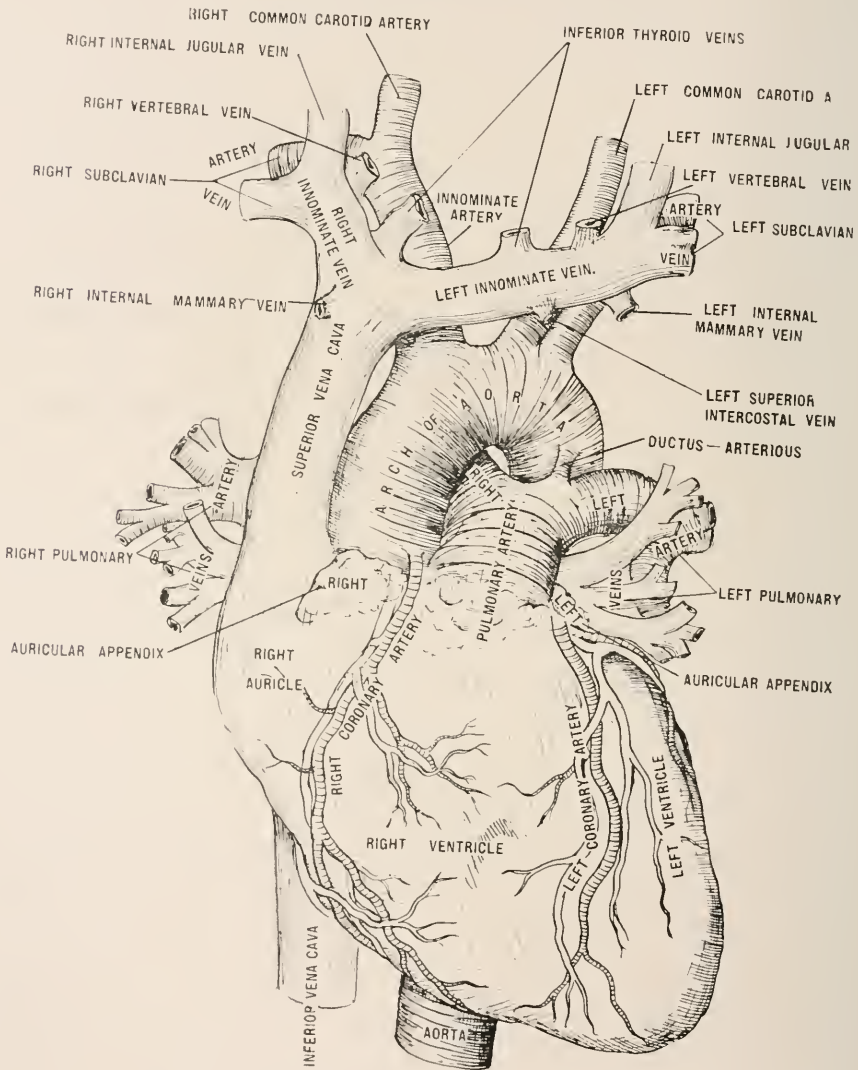
LESSON LXXXIV.

The **internal maxillary artery** (Plate CXVI) passes from the external carotid artery through the parotid gland to the inner side of the neck of the condyle of the lower jaw. It now passes forward and inward along the lower border of the external pterygoid muscle and crosses the inferior dental nerve and is situated between the internal lateral ligament and the ramus of the jaw. This much of the artery is called maxillary portion. It now passes upward and forward over the outer surface of the Internal pterygoid muscle and this portion of the artery is called pterygoid portion. It now passes between the heads of the external pterygoid muscle in the speno-maxillary fossa where it divides into its terminal branches. This portion of the artery is called speno-maxillary portion.

The branches of the **maxillary portion** are (1) **TYMPANIC** which passes upward behind the articulation of the lower jaw through the Glasserian fissure to the ear drum. This artery together with the Stylo-mastoid artery forms a vascular circle around the ear drum. (2) A **DEEP AURICULAR BRANCH** which

passes to the external meatus and outer surface of the drum. (3) MIDDLE MENINGEAL BRANCH which passes upward between the roots of the auriculo-temporal nerve to enter the foramen spinosum. It now divides into two branches (a) a posterior one which crosses the squamous portion of the temporal bone.

PLATE CXXVIII.

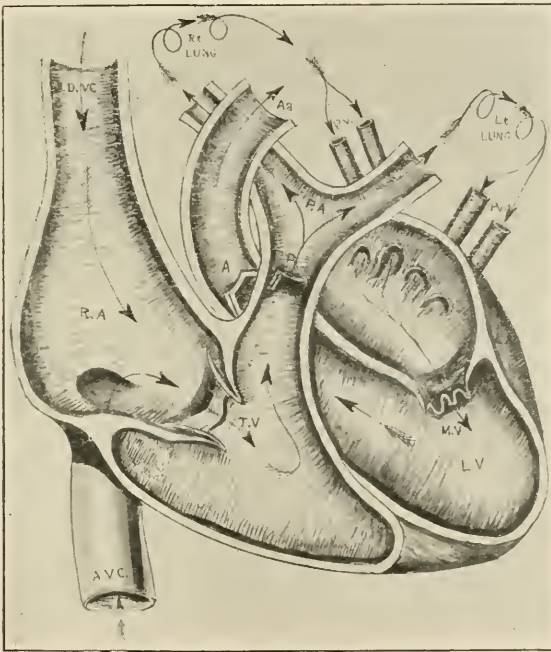


ARCH OF AORTA AND HEART.

(b) the anterior one is larger and crosses the great wing of the sphenoid to the groove in the anterior inferior angle of the parietal where it divides into branches for the dura mater and inner surface of the cranium, it also sends branches to the Gasserian ganglion and the dura mater, and a branch to the facial nerve through the hiatus Fallopii, this branch is called petrosal. It has orbital

branches which pass through the sphenoidal fissure and temporal branches which pass through foramina in the great wing of the sphenoid to the temporal fossa. (4) SMALL MENINGEAL may be a branch of the middle meningeal. It passes through the foramen ovale to the Gasserian ganglion. (5) INFERIOR DENTAL passes with the inferior dental nerve of the fifth cranial nerve into the inferior dental canal to the mental foramen where it divides into two branches, (a) the incisor branch which passes to the incisor teeth and adjacent structures, and (b) mental branch which runs through the mental foramen to the chin. A mylo-hyoid which arises at the inferior dental foramen passes in the mylo-hyoid groove of the lower jaw to the Mylo-hyoid muscle.

PLATE CXXIX.



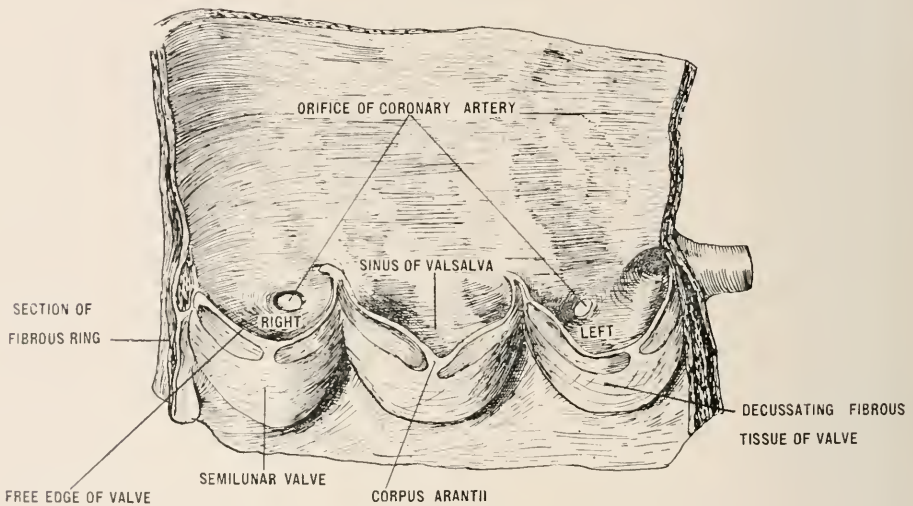
SHOWING CIRCULATION OF THE BLOOD THROUGH THE HEART.

Pterygoid portion gives off (1) ANTERIOR DEEP TEMPORAL and (2) POSTERIOR DEEP TEMPORAL, which branches pass under the temporal muscle to the temporal fossa, (3) PTERYGOID BRANCHES to the Pterygoid muscles, (4) MASSETERIC branches which pass through the sigmoid notch to the Masseter muscle, (5) BUCCAL branch which passes between the ramus and the Internal pterygoid muscle to the outer surface of the Buccinator muscle.

The **spheno-maxillary portion** gives off (1) ALVEOLAR or POSTERIOR DENTAL BRANCH, which runs to (a) the tuberosity of the superior maxillary bone, (b) posterior dental canals, (c) alveolar process, (d) gums. (2) INFERIOR ORBITAL which arises with the posterior dental runs in the inferior orbital canal to the

face and it gives off in the canal orbital branches to the orbit and anterior dental branches to the anterior dental canals, to the antrum and teeth. (3) DESCENDING PALATINE which descends in the posterior palatine canal and runs forward in a groove on the hard palate then up through the foramen of Stenson. (4) Vidian branch passes backward through the vidian canal to the pharynx and Eustachian tube, sending a branch to the tympanum. (5) PTERIGO-PALATINE which runs through the pterygo-palatine canal to the pharynx and Eustachian tube. (6) SPHENO-PALATINE which runs through the sphenopalatine foramen to the nose. It divides into external branches which pass to the lateral walls of the nose and the nasopalatine branch which descends on the septum to the foramen of Stenson.

PLATE CXXX.



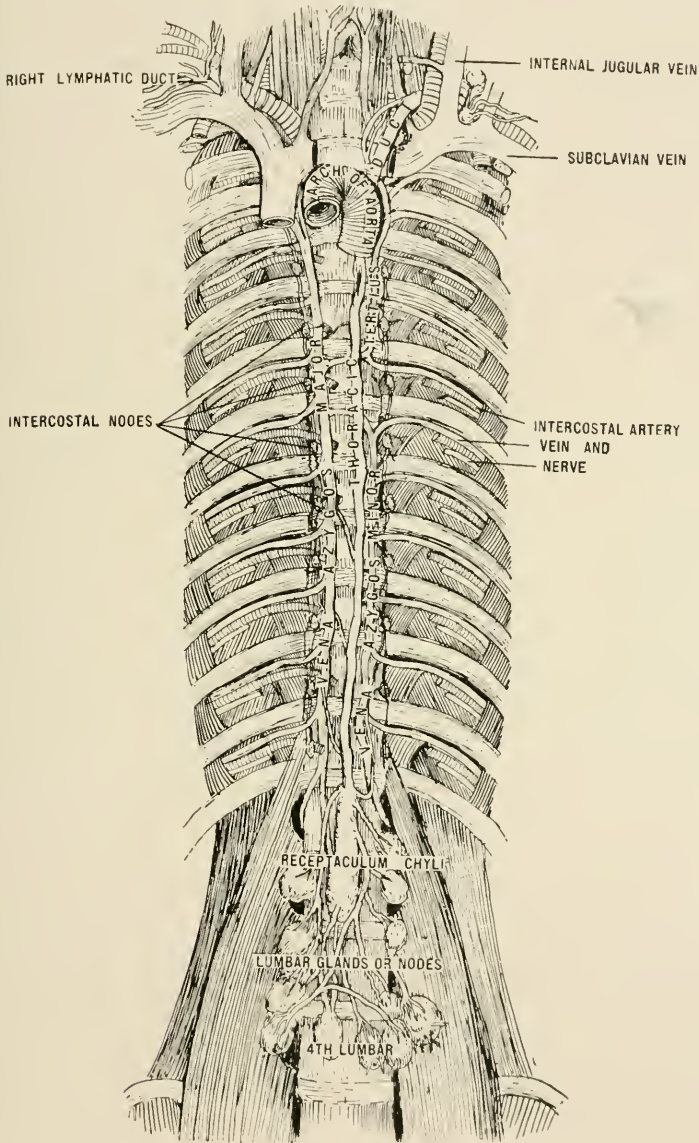
SEMILUNAR VALVES. (AORTIC.)

LESSON LXXXV.

THE FIRST THREE CERVICAL NERVES.

The anterior branch of the First Spinal nerve (suboccipital) leaves the spinal canal in the sinus atlantis beneath the vertebral artery, to the inner side of the Rectus capitis lateralis, and to the outer side of the upper articular process of the atlas. From this point it descends to the front of the transverse process of the atlas and unites with the upper branch of the second nerve thus making with it the first loop of the Cervical plexus. (Plate CXIII).

This first nerve receives a filament from the sympathetic as it crosses the foramen in the transverse process of the atlas. From the loop between the first and second fibers pass to the twelfth cranial nerve, which unite with fibers from it and descend to form the descendens hypoglossi. Other fibers from this loop join the tenth cranial nerve and the sympathetic, also pass to the Rectus capitis lateralis and the Rectus capitis anticus major and minor. The anterior

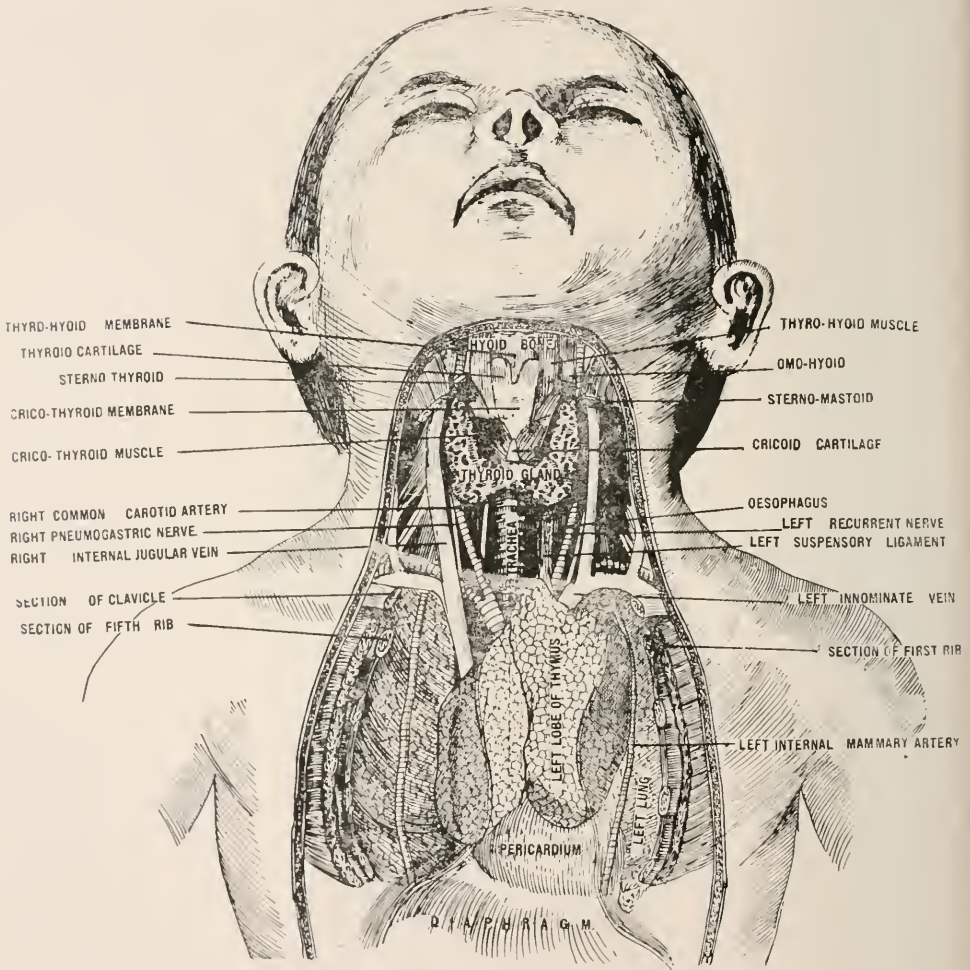


THE THORACIC DUCT AND AZYGOS VEINS.

division of the suboccipital nerve sends filaments to the occipito-atlantal articulation and the mastoid cells of the temporal bone.

The **posterior branch of the suboccipital nerve** is larger than the anterior branch and does not divide into internal and external divisions. (Principle II, Page 26). It leaves the spinal canal, as does the anterior branch, in the sinus atlantis beneath the vertebral artery, then it passes backward into the suboccipital

PLATE CXXXII.



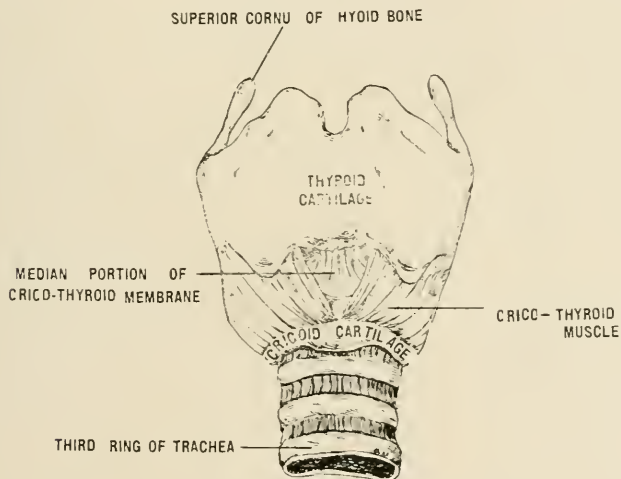
THYMUS GLAND OF FETUS.

triangle and supplies the muscles which form the triangle, viz., Superior oblique, Inferior oblique, Rectus capitis posticus major. It sends a branch to the Rectus capitis posticus minor, also to the Complexus which makes the roof of the triangle. It joins the internal division of the posterior branch of the second cervical nerve which communication passes either through or over the Inferior oblique, and it sometimes gives a cutaneous branch to the skin of the lower

part of the scalp and the upper part of the neck: this cutaneous branch accompanies the occipital artery and communicates with the great occipital and small occipital nerves. (Plate CXII).

The **superficial origin of the Second Spinal nerve** may be as high as a little above the POSTERIOR ARCH OF THE ATLAS or as low as MIDWAY BETWEEN THE POSTERIOR ARCH OF THE ATLAS and SPINE OF THE AXIS. The **anterior branch of the second cervical nerve** leaves the spinal canal between the posterior arch of the atlas and the lamina of the axis, behind the vertebral artery and in front of the posterior Intertransverse muscle. Then it passes to the interval between the Scalenus medius and Rectus capitis anticus major where it divides into an ascending branch which joins the first cervical to make the first loop, and one or two descending branches which join the third cervical to make the second loop of the cervical plexus. It gives off (1) THE SMALL OCCIPITAL NERVE, which runs upwards and backwards to the posterior border of the Sterno-mastoid, where it crosses the lower border of the spinal accessory nerve after which it

PLATE CXXXIII.



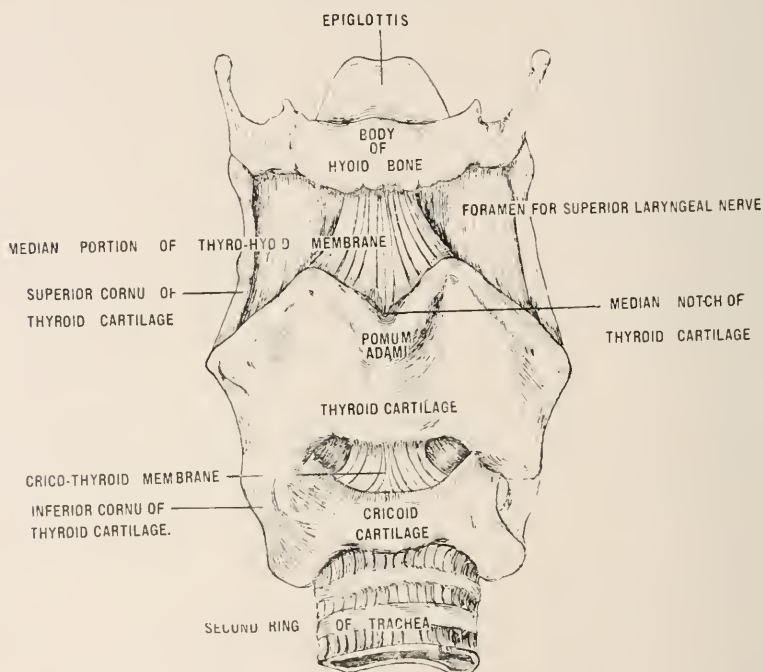
THYROID CARTILAGE. (ANTERIOR VIEW.)

ascends along the posterior border to the mastoid process. Here it pierces the deep fascia and crosses the upper part of the Sterno-cleido-mastoid into the superficial fascia where it divides into three branches, (a) auricular, which runs upwards and forward to supply the integument on the inner and upper part of the pinna, (b) a mastoid branch which is distributed to the skin on the base of the mastoid process, (c) the occipital branches which pass over the Occipitalis muscle and are distributed to the skin of the scalp. (Plate CXIII).

These branches communicate with the great occipital, small occipital, great auricular, all of the cervical plexus, and with the posterior auricular of the fifth nerve. (2) A branch helps to form the great auricular, its other branch comes from the cervical nerve. The great auricular nerve passes with the small occipital nerve to the posterior border of the Sterno-cleido-mastoid,

where it leaves this nerve and passes across the muscle towards the angle of the mandible. While crossing the muscle it lies in the deep fascia almost parallel with but behind the external jugular vein. It divides into (a) the mastoid branch which is distributed to the skin on the mastoid process, (b) the auricular branches which are distributed to the integument on the pinna at its upper part, some of these branches are distributed to the integument on the outer surface of the lobule and the outer surface of the lower part of the helix and antihelix, (c) the facial branches pass to the superficial lobules of the parotid gland and the integument over and in front of the gland. In the substance of the gland they unite with the cervico-facial division of the facial

PLATE CXXXIV.

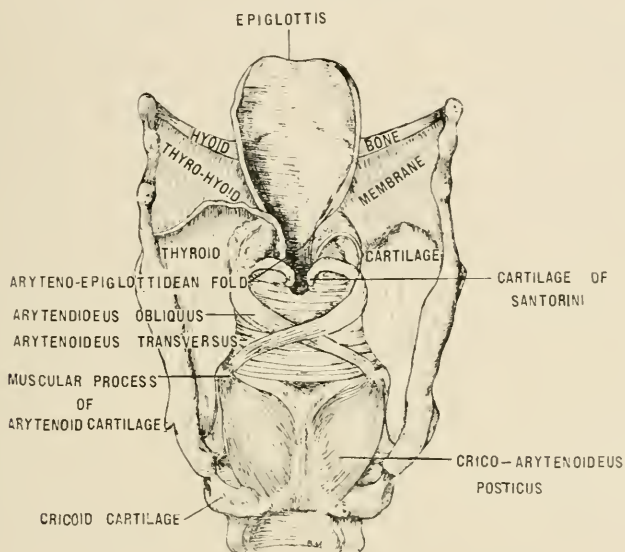


HYOID BONE, THYROID AND CRICOID CARTILAGES. (ANTERIOR VIEW.)

nerve. (3) IT GIVES A BRANCH to help from the superficial cervical nerve which comes from the second and third cervical nerves. It appears a little below the great auricular at the posterior border of the Sterno-cleido-mastoid and crosses this muscle lying under the external jugular vein, although it may perforate it or pass in front. This nerve divides into ascending and descending branches. The ascending branches supply the integument on the upper half of the neck as high as the chin. It sends a branch which accompanies the external jugular vein and another which unites with the facial. The descending branches supply the integument on the lower half of the neck as far as the sternum. (4) ONE OF THE COMMUNICANS HYOGLOSSI, and a FILAMENT TO THE STERNO-CLEIDO-MASTOID. This filament communicates with the spinal accessory in the substance of the muscle.

The **posterior branch of the second cervical nerve** leaves the spinal canal below the Inferior oblique between the posterior arch of the atlas and the lamina of the axis. This branch is larger than any other posterior branch in the cervical region and is three or four times as large as the anterior branches. It sends a twig to the Inferior and receives a branch from the first cervical nerve. It divides into a small external division which supplies the Complexus and Trachelo-mastoid and Splenius and gives a twig to the Inferior oblique, and a

PLATE CXXV.



THYROID CARTILAGES. (POSTERIOR VIEW.)

very large internal division which is the GREAT OCCIPITAL NERVE—the internal division of the posterior branch of the second cervical nerve. After this nerve crosses the Inferior oblique it pierces the Complexus, the Trapezius and the deep fascia beneath the superior curved line of the occipital bone. It joins a filament from the posterior branch of the third cervical nerve and ascends on the back of the head with the occipital artery and supplies the integument as far as the vertex, communicating with the small occipital. It gives a muscular branch to the Complexus and an auricular branch to the back part of the ear. (Plate CCXVI).

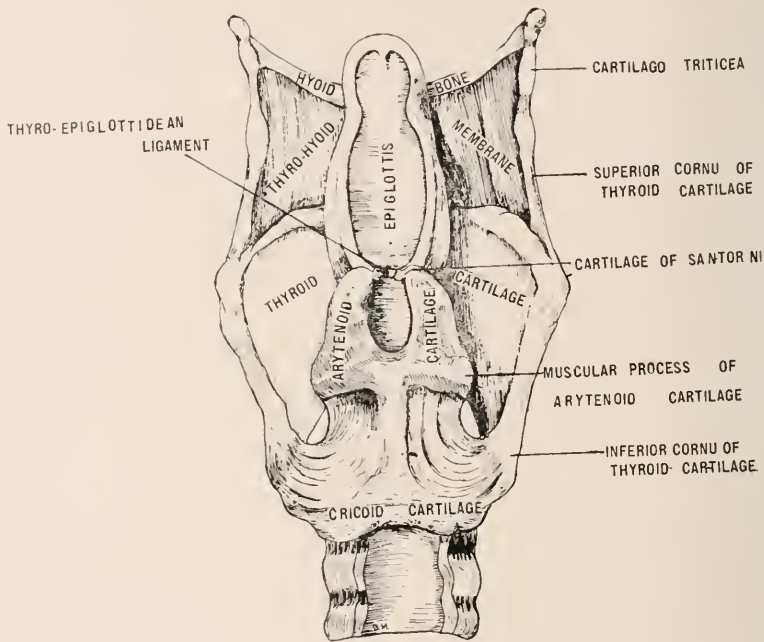
The **superficial origin of the third cervical nerve** may be as high as a little below THE POSTERIOR ARCH OF THE ATLAS or as low as THE JUNCTION OF THE UPPER TWO-THIRDS AND LOWER THIRD OF SPINE OF AXIS. The **anterior branch of this nerve** is larger than the posterior one. (Principle II, Page 26). It is also larger than the anterior branch of the second cervical nerve (double the size.)

After leaving the intervertebral foramen, it passes downward and outward beneath the Sterno-cleido-mastoid and divides into an ascending branch and a descending one. The ascending branch joins the anterior branch of second cervical nerve, in front of the Scalenus anticus. The most of the great

auricular, superficial cervical, one of the communicans hypoglossi, a branch to the supraclavicular nerves, a filament to the phrenic, and muscular branches to the Levator anguli scapulae and Trapezius, and sometimes a branch to the Scalenus medius, all come from this nerve.

The **posterior branch of the third cervical nerve** is smaller than that of the second, but larger than that of the fourth. It divides at the outer border of the Semispinalis colli into internal and external divisions. The greater portion of the internal division of the posterior branch of the third cervical nerve is the smallest or third occipital. The internal division runs between the Complexus and Semispinalis muscles, supplying them, then pierces the Trapezius to supply the integument of the back of the neck. It communicates with the great occipital.

PLATE CXXXVI.



ARYTENOID CARTILAGE AND EPIGLOTTIS.

tal nerve and supplies the skin of the scalp in the region of the external occipital protuberance. The external division joins the posterior branch of the second to supply the Splenius, Trachelo-mastoid and Complexus. (Plate CXII.)

LESSON LXXXVI.

CERVICAL PLEXUS. (Plate CXIII).

The **Cervical plexus** is formed by the anterior branches of the first four cervical nerves. Each of these four nerves receives a gray ramus communicans from the SUPERIOR CERVICAL GANGLION. This plexus is situated in the upper part of the side of the neck opposite the four upper cervical vertebræ, and upon

the Levator anguli scapulæ and the Scalenus medius muscles and under the Sterno-cleido-mastoid.

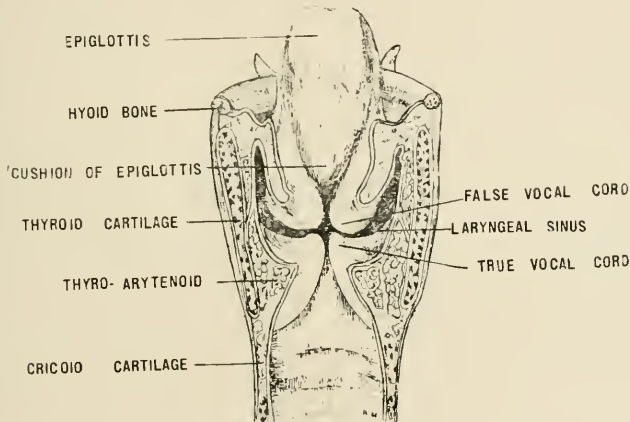
The **branches of this plexus** are **SUPERFICIAL** and **DEEP**. The superficial ones divide into **ascending** and **descending**, while the deep divide into **internal** and **external**.

The **ascending branches** are, (1) small occipital, (2) great auricular, (3) transverse cervical (this branch is sometimes called a transverse branch instead of an ascending branch).

The **descending branches** are also three, which come from one main trunk—the supraclavicular. These branches are, (1) suprasternal, (2) supraclavicular, and (3) supra-acromial.

The **internal branches** are, (1) communicating, (2) muscular, (3) communicans hypoglossi, (4) phrenic.

PLATE CXXXVII.



TRUE AND FALSE VOCAL CORDS.

The **external branches** are, (1) communicating, (2) muscular.

The **small occipital nerve** (Plate CCXVI) is sometimes double, and it varies in size. This nerve is derived from the second cervical nerve (and third) and after passing to the back of the posterior border of the Sterno-cleido-mastoid, it passes along this muscle to the mastoid process of the temporal bone where it perforates the deep fascia and passes into the superficial fascia of the scalp. It breaks up into three branches. (1) An auricular branch which supplies the integument on the inner and upper part of the pinna. (2) A mastoid branch which is distributed to the integument on the mastoid process. (3) Occipital branches which are distributed to the integument of the scalp and communicate with the great occipital, great auricular, and posterior auricular nerves.

The **great auricular nerve** (Plate CCXVI) is derived from the second and third cervical nerves and after passing to the posterior border of the Sterno-cleido-mastoid, it perforates the deep fascia and ascends upon this muscle beneath the Platysma to the parotid gland. This nerve lies almost parallel with

and behind the external jugular vein. It divides into three branches, (1) auricular, which are three or four, anastomose with the auricular branches of the facial and pneumogastric nerves. It is distributed to the integument of the lobule and the lower part of the concha. (2) A mastoid branch which is distributed to the integument over the mastoid process. This branch anastomoses with the small occipital and posterior auricular nerves. (3) The facial branch crosses the parotid gland and supplies the integument covering the gland. It communicates with the seventh nerve in the gland.

The **transverse cervical nerve** (*superficialis colli*) (Plate CCXVI) comes from the second and third cervical nerves and passes around the posterior border of the Sterno-cleido-mastoid near its middle a little below the great auricular nerve. It now passes across the neck beneath the integument, *Platysma*, and external jugular vein (sometimes over the vein) to spread out into an ascending and a descending branch. The ascending branch joins the cervical branches from the facial nerve and supplies integument of the upper part of the neck as high as the chin. The descending branch supplies the integument of the lower half of the neck as far as the sternum.

The **communicating branches of the external division of the deep branches** are, (1) a communicating branch from the second cervical nerve to the Sterno-cleido-mastoid. (2) Those from the third and fourth cervical nerves are distributed to the *Trapezius*.

Muscular branches to (1) the Sterno-cleido-mastoid come from the second cervical nerves and joins the spinal accessory nerve in the substance of the muscle. (2) To the *Scalenus medius*, which comes from the third and fourth cervical nerves and the loop between them. (3) To the *Levator anguli scapulae*, which comes from the third, fourth, and sometimes the fifth cervical nerves. It occasionally comes from the second also. (4) To the *Trapezius* which comes from the third and fourth cervical nerves.

The **communicating branches of the internal division of the deep branches** are, (1) gray rami communicantes from the superior cervical ganglion to each of the first four cervical nerves, (2) a communicating branch to the pneumogastric, also one to the hypoglossal, (3) communicating branches, which pass to the descendens hypoglossi from the second and third cervical nerves, (4) a branch from the fourth cervical nerve to the fifth cervical nerve.

Muscular branches pass to the (1) *Rectus capitis anticus minor*, (2) *Rectus capitis anticus major*, (3) *Rectus capitis lateralis*, (4) *Longus colli*.

Communicans hypoglossi is formed by branches from the second and third cervical nerves and pass down on the outer side of the internal jugular vein to the middle of the neck where they join the descendens hypoglossi.

This loop is called *ansa hypoglossi*. Branches are given off from this *ansa* to the Sterno-hyoid, Sterno-thyroid, and Omo-hyoid.

The **phrenic nerve** (internal respiratory of Bell) is derived from the third, fourth, and fifth cervical nerves, mainly from the fourth. As it descends in the neck it has behind it the *Scalenus anticus* and in front of it (1) the Sterno-cleido-mastoid, (2) the posterior belly of the Omo-hyoid, (3) the *transversalis colli*

vessels, (4) the suprascapular vessels. It now passes between the first part of the subclavian artery and the subclavian vein, and as it passes into the chest it crosses the beginning of the internal mammary artery. It now passes vertically downward in front of the root of the lung between the pericardium and the mediastinal portion of the pleura. It perforates the Diaphragm and is spread out on its under surface.

The **right phrenic nerve** lies on the outer side of the right innominate vein and the superior vena cava. It is not as long as the left phrenic nerve and is more vertical in direction, also seated deeper.

The **left phrenic nerve** is longer than the right phrenic nerve for two reasons, (1) it has further to go, because the Diaphragm is lower on the left side, and (2) it goes in a less direct route, because the heart inclines to the left side. As it enters the thorax it lies behind the left innominate vein and in front of the pneumogastric nerve, the arch of the aorta, and the root of the lung. The **comes nervi phrenici**, which is a branch of the internal mammary artery, passes to the phrenic nerve.

The pericardium, pleura, (and peritoneum?) are supplied by the phrenic nerve. The nerve to the subclavius muscle sends a branch to the phrenic nerve, a branch from the sympathetic and one from the junction of the descendens hypoglossi with the cervical nerves pass to the phrenic nerve.

The right phrenic nerve, after it passes through the Diaphragm, joins a branch from the solar plexus to form a ganglion, which gives branches to the hepatic plexus, the suprarenal capsule, and the inferior vena cava.

The left phrenic nerve has no ganglion upon it, but joins the phrenic plexus.

LESSON LXXXVII.

The **abdominal wall** is divided into nine arbitrary areas by four lines; first a circle around the body connecting the anterior superior spinous processes of the crest of the ilia; a second line drawn around the body connecting the tips of the ninth or tenth ribs; the other two lines are drawn at right angles to these from the middle of Poupart's ligament, thus dividing the abdominal wall into nine areas. Plate CCXXV.

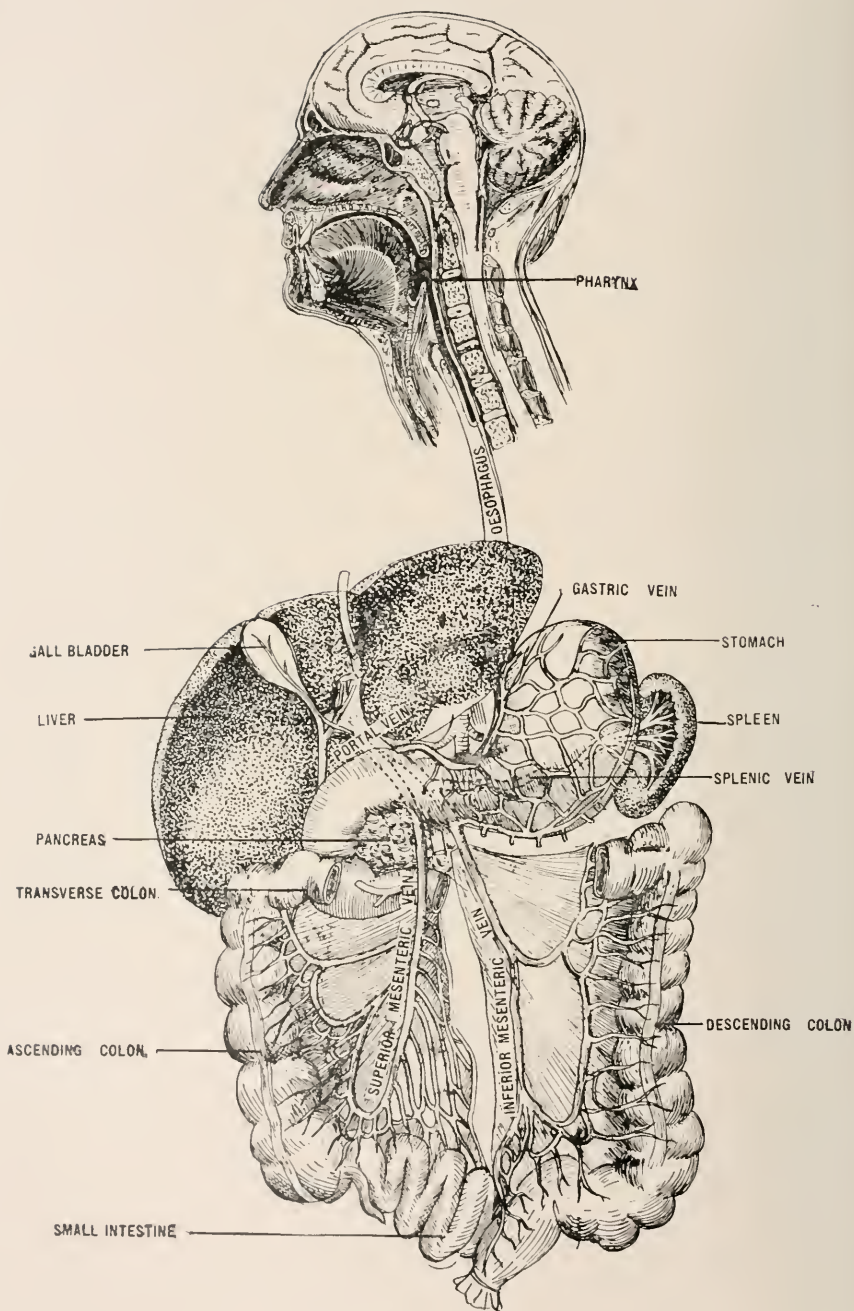
The first one above and on the right side is called the **right hypochondriac**; the middle one above is the **epigastric**; the third one the **left hypochondriac**. The first one in the middle row on the left side is the **left lumbar**; the next one is the **umbilical**; and the third is the **right lumbar**. The one below the right lumbar is the **right iliac or inguinal**; the next one in the third row is the **hypogastric**; and the third one is the **left iliac or inguinal**.

EPIGASTRIC ("upon the stomach"). HYPOCHONDRIAC ("under the cartilage.") HYPOGASTRIC ("under the stomach.")

The **right hypochondriac** contains the right lobe of the liver, gall-bladder, hepatic flexure of the colon, and upper part of the right kidney.

Right lumbar contains the ascending colon, lower part of the right kidney, and some coils of the small intestine (ileum.)

Right inguinal (iliac) contains the caecum, often the appendix vermiformis, and the end of the ileum.



SHOWING THE ENTIRE ALIMENTARY CANAL AND THE PORTAL CIRCULATION.

Epigastric contains part of the right lobe of the liver, greater part of the left lobe, part of the gall-bladder, stomach, middle and pyloric portions, both orifices, first two parts of the duodenum, duodeno-jejunal junction, pancreas, except the tail, upper part of the spleen, part of the kidneys, suprarenal capsules.

Umbilical contains the transverse colon, part of the great omentum and mesentery, transverse portion of the duodenum, and some coils of the jejunum and ileum, part of both kidneys with ureters, and the receptaculum chyli.

Hypogastric contains coils of the small intestine, the bladder in children, or when distended in adults, ureters, the uterus during the latter months of pregnancy, often the caecum, appendix vermiformis, sigmoid flexure of the colon, and the upper part of the rectum.

Left hypochondriac contains the fundus of the stomach, greater part of the spleen, tail of the pancreas, splenic flexure of the colon, upper part of the left kidney, and part of the left lobe of the liver.

Left lumbar contains the descending colon, part of the omentum, sigmoid flexure, lower part of the left kidney, and some coils of the jejunum.

Left inguinal (iliac) contains the sigmoid flexure of the colon and convolutions of the jejunum and ileum.

ALIMENTARY CANAL. (Plate CXXXVIII).

The **alimentary canal** is about thirty feet in length, extending from the mouth to the anus. It is a musculo-membranous tube and consists of the following portions: mouth, pharynx, œsophagus, stomach, small intestine which has the following divisions, (1) duodenum, (2) jejunum, and (3) ileum, and then comes the large intestine which has the cæcum, ascending colon, hepatic flexure, transverse colon, splenic flexure, descending colon, sigmoid flexure, and rectum. The accessory organs to the alimentary canal are the teeth, salivary glands, liver, spleen, and pancreas.

A **viscus** is any internal organ of the body. The viscera are situated in the cranium, thorax, abdomen, and pelvis. The Diaphragm lies immediately above the stomach. All of the canal above the Diaphragm has three coats which are from within outward the mucous membrane, areolar tissue or submucous and muscular. That portion of the canal which lies below the Diaphragm has a fourth coat called the **SEROUS MEMBRANE**, which is external to the muscular coat.

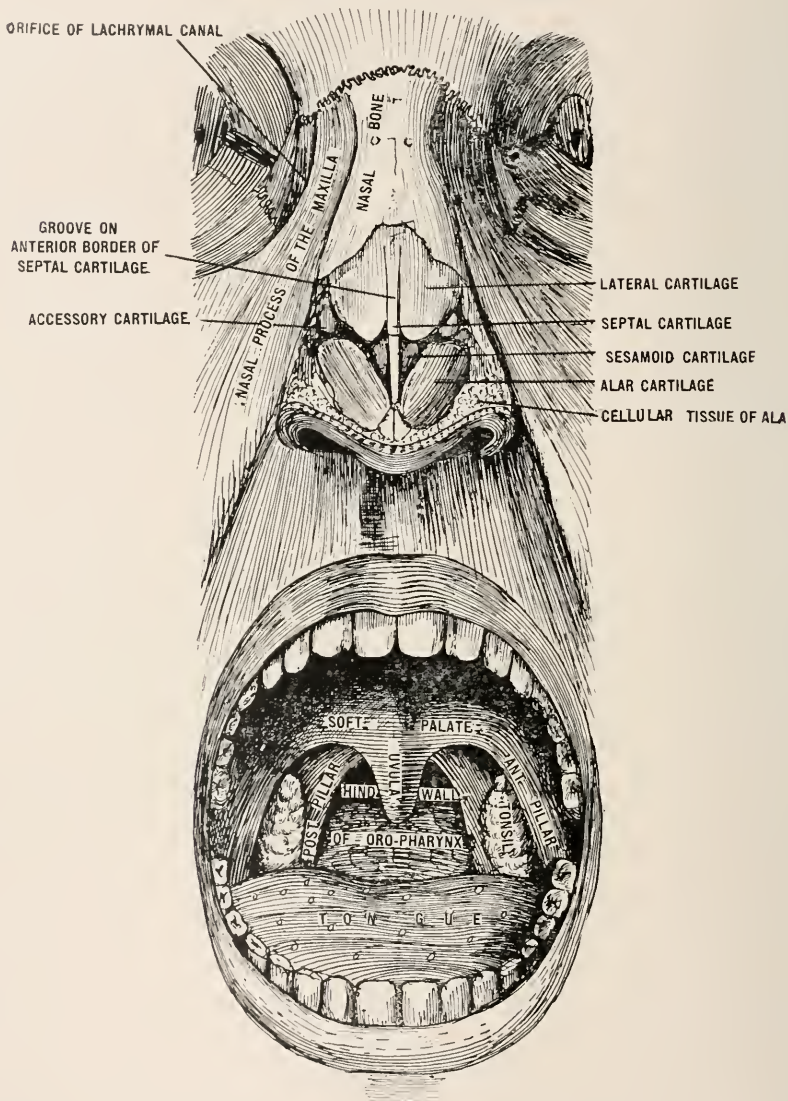
The **teeth** (Plate CCXXVI) are dense white structures firmly implanted in sockets in the alveolar processes of the jaw bones. Each consists of three portions—A **ROOT** OR **FANG**, A **NECK**, and A **CROWN**. The teeth grow in two sets, one in infancy, the other in childhood and youth. The first set are called **temporary, milk, deciduous** teeth and are twenty in number, there being five in each lateral half jaw, namely two incisors, one canine, and two molars. In this set there are no bicuspid and no third molar. The bicuspid of the permanent set take the place of the temporary molars.

In the **second or permanent set** there are thirty-two teeth; eight in each lateral half jaw, two incisors, one canine, two bicuspid, and three molars.

The ARTERIES to the teeth are derived from the inferior dental and from the alveolar and infraorbital branches of the internal maxillary.

The NERVES are from the inferior dental branch of the inferior maxillary

PLATE CXXXIX.



THE ANTERIOR AND POSTERIOR PILLARS OF THE FAUCES AND CARTILAGES OF NOSE.

division of the fifth, and also from the anterior and posterior dental branches of the superior maxillary division of the same nerve.

Just before the six-year molars are erupted from the gum, forty-eight teeth in various stages of formation and retrogression can be recognized in the

two jaws—twenty of the temporary set and twenty-eight of the permanent set. The four wisdom teeth at this time are only embryonic buds.

In a sagittal section of a tooth we see first the **enamel** (Plate CCXXVII) which is the hardest structure in the body, consisting of 96.5 per cent earthy and 3.5 per cent animal matter. Its individual tubules are $\frac{1}{5500}$ of an inch in diameter. Beneath the enamel is the **dentine** or **ivory**. The amount of earthy matter is 72 per cent and the animal matter 28 per cent. Its tubules are $\frac{1}{1500}$ of an inch in diameter and are covered by the sheath of Neumann, which protects it from the action of acids. The cavity in the tooth is called the pulp cavity and contains the blood vessels but no lymphatics. The tissue in the cavity is called myxomatous. The part which surrounds the root as the enamel surrounds the crown is called the **crusta petrosa** (Plate CCXXVII).

There are two kinds of muscles found in the **tongue** (Plate CXLV) intrinsic and extrinsic. The intrinsic are the Superior lingualis, Inferior lingualis, Transverse lingualis, and Vertical lingualis. They are all supplied by the hypoglossal nerve. Some say the Inferior lingualis gets the Chorda-tympani branch of the the seventh nerve. The extrinsic muscles are the Genio-hyo-glossus, Palato-glossus, Hyo-glossus, Stylo-glossus, and Chondro-glossus. The nerve to these is the hypoglossal.

PAPILLA means a bud, a nipple, a teat, a pimple. The lingual mucous membrane of the dorsum of the tongue is peculiar in several respects. It consists of a layer of connective tissue forming a corium supporting special papillæ covered with epithelium. The corium is a network in which ramify numerous vessels and nerves. The papillæ are of three kinds.

LESSON LXXXVIII.

1. **Large circumvallate** ("walled around") **papillæ** seven in number set in an inverted V at the back of the tongue and shaped like truncated cones set on end in cup-like depressions, whence the name. (Plate CXLIII).

2. **Middle-sized fungiform** ("mushroom shaped") **papillæ** scattered irregularly over the surface, forming rounded red eminences like mushrooms, whence their name.

3. **Small conical** or **filiform** ("thread-shaped") **papillæ** covering the anterior two-thirds of the surface, each ending in a number of little processes. It is these that are concerned in the whitish coating or furring of the tongue. Besides these papillæ there are several other simple ones.

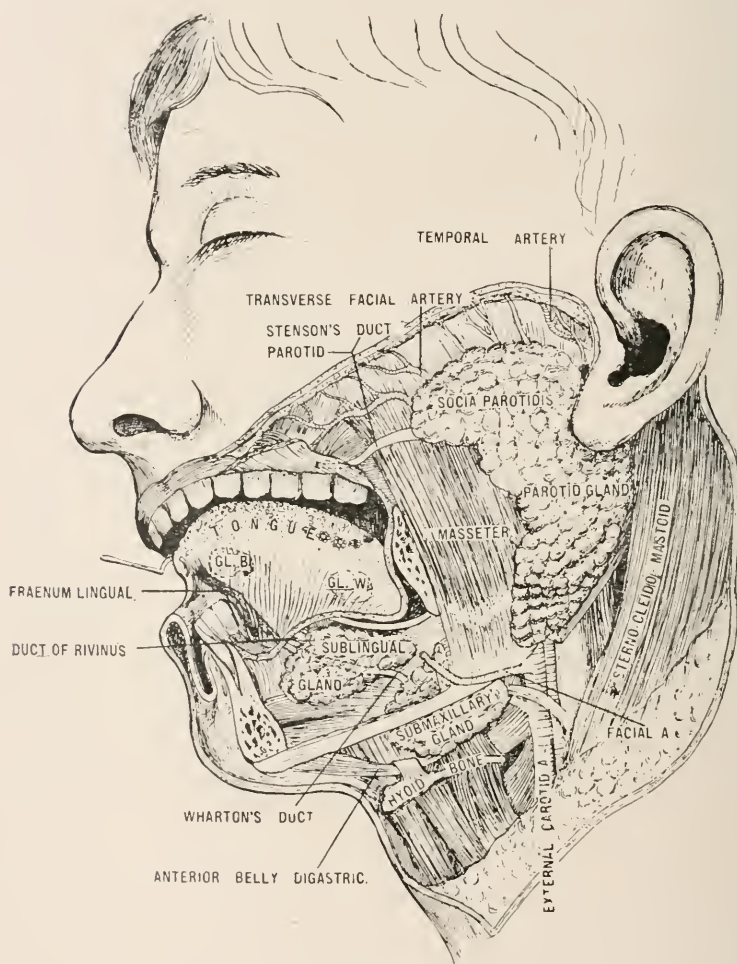
Occupying the entire thickness of the epithelium of the lateral surface of the papillæ is a multitude of flask-shaped bodies, called taste-buds. They are composed of two kinds of epithelial cells, gustatory and sustentacular, packed closely together. The microscopic structure of some papillæ include certain bodies called taste-buds. Taste-buds are scattered also over the dorsal surface independently of papillæ, and are especially numerous in the posterior part.

THE NERVES OF THE TONGUE ARE IN FOUR PAIRS. 1. The hypoglossal is the **motor nerve** to the tongue.

2. The lingual (gustatory) of trifacial is distributed to the anterior two-thirds of the dorsum of tongue and also to sides of tongue. This nerve is **one of sensation**. Formerly it was thought to be a nerve of taste, whence the name (gustatory,) which it still retains.

3. The lingual branch of glosso-pharyngeal is especially concerned in **gus-**

PLATE CXL.



SHOWING THE SALIVARY GLANDS

tation (taste) and is distributed to the posterior one-third of dorsum and sides of tongue. (Plate CXLIII).

4. The function of the lingual branch of the facial (Chorda-tympani) is still in question. Its distribution is about the same as the lingual branch of the fifth. Some say it is a **nerve of taste** for the anterior two-thirds of the tongue. Others say that it supplies the **Inferior lingualis muscle**. Still others say that

the anterior two-thirds of the tongue is supplied by the glosso-pharyngeal through the chorda-tympani.

The **blood supply** of the tongue is derived from the lingual, the facial, and ascending pharyngeal arteries. The veins of the tongue accompany the arteries.

There are two kinds of glands in the tongue. (Plate CXL), the mucous and serous. The mucous glands are found all over the surface of the mucous membrane of the tongue. The serous are found only at the back of the tongue.

The **fraenum linguae** is a fold of the mucous membrane of the mouth which binds down the under surface of the tongue and sometimes requires to be cut from too great restriction or from extension too far forward, causing the subject to be tongue-tied. *Fraenum linguae* means bridle of tongue.

The dorsum of the tongue is convex, marked along the middle line by a raphe, which divides it into symmetrical halves; this raphe terminates behind, about an inch, from the base of the organ, in a depression, the **foramen caecum**,

The tongue is not the only organ of taste as taste-buds are found on the back part of the hard palate, on anterior part of the soft palate, and to some extent in other parts of the pharynx.

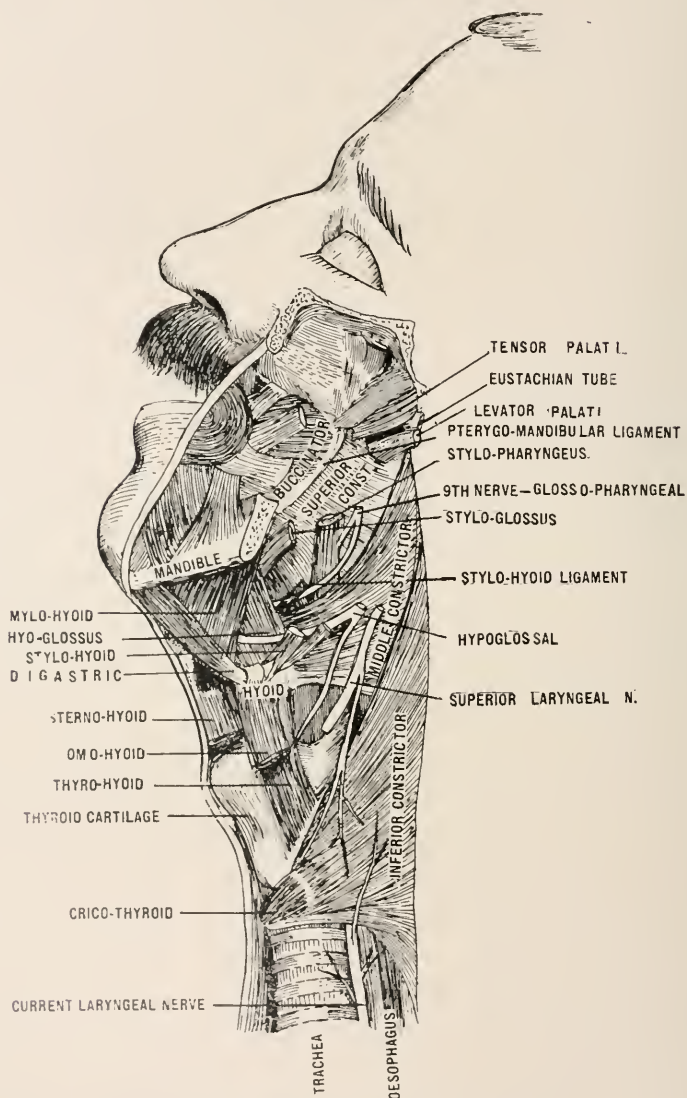
The **lymphatic vessels** from the tongue pass to one or two small glands situated on the Hyo-glossus muscle in the sub-maxillary region, and from thence to the deep glands of the neck.

The **pharynx** (Plate CXLII) is **bounded above** by (1) the base of the sphenoid bone and (2) the basilar process of the occipital; **behind** by (1) the vertebral column, (2) Longus colli and (3) the Recti capitis antici muscles; it is incomplete **in front** being bounded by the (1) internal pterygoid plate, (2) pterygo-maxillary ligament, (3) the lower jaw, (4) the tongue, (5) the hyoid bone, (6) the thyroid and (7) cricoid cartilages. **On the sides** by (1) the styloid process and (2) its muscles, (3) the common carotid and (4) internal carotid arteries, (5) the internal jugular vein, (6) ninth, (7) tenth, (8) twelfth, and (9) sympathetic nerves and (10) a portion of the Internal pterygoid muscle. It has **seven openings**, two posterior nares, two Eustachian tubes, the oesophagus, the mouth, and the larynx. On its posterior wall between the two Eustachian tubes there is a collection of lymphoid tissue similar to that found in the tonsils which forms the **pharyngeal tonsil** or **the third tonsil**. Above this is the bursa pharyngea, which some authors think has something to do with the development of the anterior part of the pituitary body and others think it has something to do with the development of the third tonsil.

The pharynx, the throat, technically the joint opening of the gullet and the windpipe, is a musculo-membranous pouch situated at the back of the nasal cavities, mouth and larynx and extending from base of skull to the cricoid cartilage. It is about five inches long. It is widest (nearly one inch and a half) in the upper pharyngeal portion, and narrow above and below, having its least diameter (half an inch) at its junction with the gullet. Ventro-dorsally its measurement is everywhere small, only opposite the mouth being more than four-fifths of an inch. It is a cavity situated in front of the upper five cervical

vertebræ. The pharynx also belongs to the respiratory system. The middle segment of the pharynx is common to the alimentary and respiratory systems, and the tracts followed by the food and air cross obliquely in it. The pharynx has three tunics, the mucous, areolar, and muscular.

PLATE CXLI.



SHOWING THE MUSCLES OF THE PHARYNX.

The muscles of the pharynx (Plate CXLI) are Superior constrictor, Middle constrictor, Inferior constrictor, Stylo-pharyngeus, Palato-pharyngeus, and Salpingo-pharyngeus. The Constrictors are supplied by branches from the pharyngeal plexus. The Stylo-pharyngeus by the glosso-pharyngeal nerve

and the Inferior constrictor gets, in addition, branches from the external laryngeal nerve and the recurrent laryngeal. The Palato-pharyngeus probably gets its nerve supply from the internal branch of the spinal accessory, whose fibers are distributed along with certain branches of the pneumogastric through the pharyngeal plexus.

The pharyngeal plexus is formed by branches of the vagus, sympathetic and glosso-pharyngeal. It supplies the muscles and mucous membrane of the pharynx.

The blood supply of the pharynx is from the superior thyroid branches, ascending pharyngeal, pterygo-palatine, and descending palatine. The first two are branches of the external carotid, the last two are branches of the internal maxillary.

The **sinus of Morgagni** is a space at the upper and back part of the Superior constrictor of the pharynx, just under the base of the skull where the muscular fibers of the Constrictor are deficient, the pharynx being consequently walled in behind by its own aponeurosis. Here the Eustachian tube opens into the pharynx, one on each side.

LESSON LXXXIX.

The **tonsils** (Plate CXXXIX) are two prominent oval bodies situated in the recesses formed one on each side of the fauces, between the anterior and posterior palatine arches. They are composed of lymphoid follicles, surrounded by less dense lymphoid tissue arranged around the walls of crypts. They lie near the internal carotid artery. The blood supply is from the dorsalis linguæ from the lingual; ascending pharyngeal from external carotid; ascending palatine from facial; tonsillar from facial; descending palatine from internal maxillary. (Plate CXVI) The veins of the tonsil form a plexus which lies upon the outer side of the gland and opens externally into the pharyngeal plexus. The nerves to the tonsils come from the fifth by means of Meckel's ganglion and from the glosso-pharyngeal nerve.

Steno's duct (Stenson's) (Plate CXL) is a duct of the parotid gland conveying saliva into the mouth; so named from the Danish anatomist, Nicholas Steno, of Copenhagen (1638-86). This duct is also called parotid duct.

Wharton's duct named from Thomas Wharton, an English physician, 1656. The duct of the submaxillary gland, conveying saliva into the mouth, about two inches long, opening on a papilla at the side of the fraenum linguæ, or bridle of the tongue.

The **ducts of Rivinus** are those ducts of the sublingual gland which open apart from one another and from Wharton's duct.

The **duct of Bartholin** is one of the ducts of the sublingual gland running along side of Wharton's duct, and opening into it or close to its orifice into the mouth.

The **hard palate** (Plate CCXXVIII) is in the roof of the mouth and is formed by the palate processes of the superior maxillary and palate bones. The soft palate is a movable fold suspended from the posterior border of the hard palate, form-

The next part of the alimentary canal is called the **œsophagus** (Plate CXLVI) which extends from the spinous process of the sixth cervical vertebra to the cardiac end of the stomach opposite the spinous process of the ninth dorsal. It consists of three coats, an outer or muscular, a middle or areolar, and an internal or mucous. All of the alimentary canal above the diaphragm has three coats, and all below it has four coats, these three just mentioned and a serous coat or peritoneum.

The **œsophagus** (Plate CXLVI) IN THE NECK, is bounded in front by the trachea, the thyroid gland, and the thoracic duct. On each side by the common carotid artery, the lateral part of the lobes of the thyroid gland, and the recurrent laryngeal nerve. Behind by the vertebral column and the Longus colli.

IN THE THORAX it is bounded in front by the trachea, arch of the aorta, left common carotid artery, left subclavian artery, left bronchus, pericardium, and Diaphragm. Behind by the vertebral column, Longus colli, vena azygos minor, right intercostal arteries, thoracic duct, aorta, and the abdominal aorta. On the right side by the right lung and pleura, vena azygos major, and the thoracic duct. On the left side by the left lung and pleura, and thoracic aorta. The left pneumogastric and right pneumogastric surround the œsophagus, the right being situated behind it and the left in front, forming the plexus of Gulæ in the muscular coat.

The **muscular coat** consists at first of three perpendicular bands, the anterior one being attached to the posterior part of the cricoid cartilage and the lateral ones being continuous with the Inferior constrictor of the pharynx. These three bands gradually blend and make a circular muscular band around the œsophagus. The next coat is the circular coat which is continuous with the fibers of the Inferior constrictor and at the upper part of the œsophagus they are parallel and at the lower part they are parallel, but in the intermediate portion they are oblique. The upper ones are striped or voluntary muscles, while the lower ones are involuntary. The glands of the esophagus are compound racemose glands which empty by long tubes on the mucous membrane.

The **œsophagus** (carrying eatables) or **gullet** is a tube connecting the pharynx and stomach. It is about ten inches long. The blood supply is from the inferior thyroid which comes from the thyroid axis of the subclavian; branches from the descending thoracic aorta; and from the gastric branches of the coeliac axis of abdominal aorta. The nerve supply is from the pneumogastric and sympathetic. They form a plexus in which are groups of ganglion-cells between the two layers of the muscular coats, and also a second plexus in the submucous tissue.

LESSON XC.

The **stomach** (Plate CXLVI) is the most dilated and most distensible part of the alimentary canal. It occupies parts of the left hypochondriac and epigastric regions of the abdomen, immediately within the abdominal walls below the diaphragm and partly under the liver to the right of the spleen and above the transverse colon. In form it is irregularly conoidal and curved upon itself. When moderately distended it is about twelve inches long and four inches wide; it weighs three or four ounces. The size, shape, and hence anatomical relations, differ greatly in different states of distension. It is somewhat like a pear with the large end up and the small end bent sidewise to the right. The fundus or splenic end is connected to the spleen by the gastro-splenic omentum. We might mention that an omentum is a special mesentery connecting the stomach with the liver, spleen, and colon respectively. The one that connects it to the spleen is called gastro-splenic omentum. The one that connects it to the liver is called the gastro-hepatic omentum, and the one to the colon is called the gastro-colic omentum. The pylorus or lesser end lies near the cartilage of the eighth rib, in contact with the under surface of the liver. The stomach has two curves, a greater and a lesser. The greater is convex and is connected to the colon by the gastro-colic omentum. The lesser one is concave and is connected to the liver by the gastro-hepatic omentum, and to the Diaphragm by the gastro-phrenic ligament. The cesophageal or cardiac orifice is situated between the fundus and the lesser curvature.

The **pyloric** (janitor) is situated at the extreme right and is more anterior in position than the cardiac orifice. The stomach has four tunics, serous, muscular, areolar or submucous, and mucous. The serous coat (peritoneum) encloses the stomach between two layers, derived from the lesser omentum. The lesser omentum, omentum minus, or gastro-hepatic is a single fold (two layers) of peritoneum, extending between the transverse fissure of the liver and the LESSER CURVATURE of the stomach. It might be well to explain the **greater omentum**, **omentum magnus** or **gastro-colic omentum** also called **epiploon**. It is the largest of all peritoneal duplications, and consists of four layers of peritoneum attached to the greater curvature of the stomach and to the transverse colon, whence it is looped down freely upon the intestines, forming a great flap or apron. The muscular coat has two distinct layers—an outer, longitudinal, and an inner, circular. Besides these two distinct layers some oblique fasciculi are found internal to the circular. The areolar, submucous, also called vascular, is loose, and its meshes are largely occupied with the vessels and nerves going to and from the coats between which it lies. The mucous coat is thrown into irregular longitudinal folds called rugæ. The rugæ invade the mucous and submucous coats.

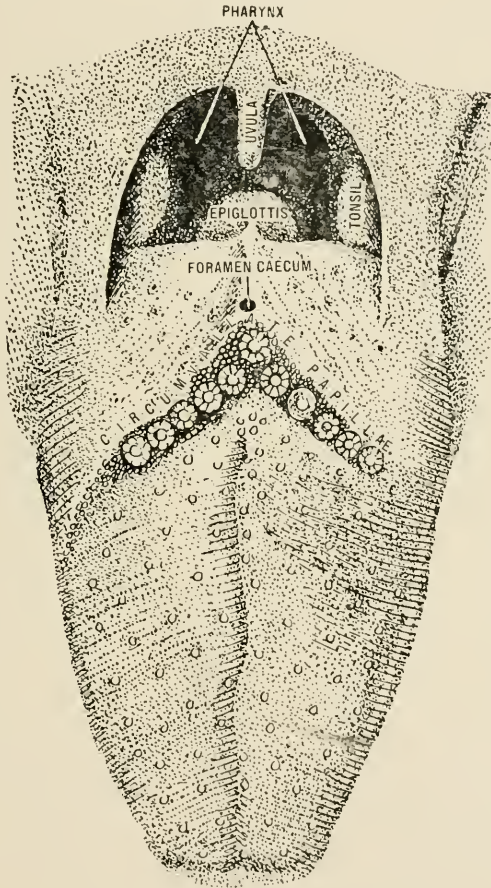
There are two kinds of glands in the stomach, the **cardiac** or **proper gastric glands** also called **peptic** (digest), and the **pyloric glands**.

The **nerve supply** to the stomach is the right and left pneumogastric and branches from the solar plexus of sympathetic nerves.

The **blood supply** to stomach (Plate CXLVIII) is from the coeliac axis.

(1) the gastric artery which runs along the lesser curve from left to right anastomosing with the (2) pyloric branch of the hepatic. Along the greater curve run the (3) right and (4) left gastro-epiploic arteries, anastomosing at the middle of the border, the left being a branch of the splenic, the right a branch of the hepatic through the gastro-duodenalis artery. The stomach also receives branches from the splenic (5) vasa brevia at the fundus. The blood of the stomach is returned into the portal vein; the right gastro-epiploic vein opens into the superior mesenteric, the left into the splenic. The lymphatics are

PLATE CXLIII.



THE DORSUM OF THE TONGUE.

numerous; they consist of a superficial and deep set which pass through the lymphatic glands forward along the two curvatures of the stomach.

The stomach has above it, (Plate CXLIX), the Diaphragm, lesser omentum, and the liver; in front, the Diaphragm, the liver, and the anterior abdominal wall; below it, the great omentum, the transverse colon, and the gastrosplenic omentum; behind it, the kidney, suprarenal capsule, pancreas and spleen, which are called the "Big-four." The "Little-four" which are the great vessels, solar transverse meso-colon, and crura of the diaphragm are also behind it.

LESSON XCI.

The **first part** of the small intestine is called the duodenum; the literal meaning of which is twelve finger lengths, but this is not twelve finger lengths or twelve finger breadths. It has a mesentery. The duodenum may consist of five portions, the transverse, descending, inferior transverse, ascending, and the flexure—duodeno-jejunal flexure. It has glands in it called Brunner's glands or duodenal glands.

The **next part** of the small intestine is called jejunum, and the **third part** is called ileum. The first portion consists of about three-fifths of it below the duodenum, and the ileum about two-fifths. The glands in the ileum are called Peyer's patches which are about thirty in number; the intestine is thinner here than in other parts. The small intestine straightened out would be in the shape of a slender cone, with the base corresponding to the stomach end, and its apex corresponding to the point where it joins the caecum.

The **large intestine** consists of first, the CÆCUM which may be various shapes and is partly covered with peritoneum; the next part is the ASCENDING COLON which in 27 per cent of cases is covered with peritoneum; it is about eight and one-half inches long. The next portion is the HEPATIC FLEXURE which joins the ascending with the transverse colon. This TRANSVERSE COLON is about twenty inches long, and is covered with peritoneum. The next part is the splenic flexure which joins the transverse with the DESCENDING COLON. The descending colon is about nine inches in length and in 37 per cent of cases is covered with peritoneum. The next part is called the SIGMOID FLEXURE, which is about fourteen inches in length. The last part is the RECTUM (which means straight); it is not straight but relatively straight compared with the rest of the alimentary canal.

The glands of the large intestine are less numerous, and lie along the vascular arches of the arteries or even upon the gut itself; they are fewest along the transverse colon.

The **lymphatic vessels of the large intestine** form two sets, viz., those of the cæcum, ascending and transverse colon, which pass through their proper glands to the mesenteric glands; and those of the descending colon, sigmoid flexure, and rectum which pass to the lumbar glands.

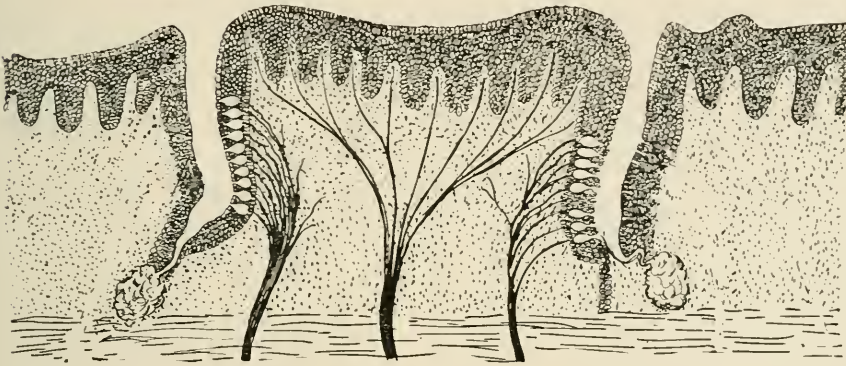
The **small intestine** (intestinum tenue,) (Plate CLVI), extends between the stomach above and the large intestine below. Its average length is about twenty-two feet. It may be as many as thirty-four feet or as few as eight feet in length. Its diameter diminishes in size from about two inches above to less than one inch below. It is to a large extent within the area bounded by the colon, occupying the umbilical and hypogastric regions and the adjacent portions of the lumbar. It has four coats which correspond in general arrangement and character to those of the stomach. They are the serous, muscular, areolar, and mucous. The divisions of the small intestine are the duodenum (twelve finger intestine,) jejunum (empty intestine,) and ileum (curved or twisted intestine.) The villi are small projections on the mucous membrane of

the small intestine, which are so numerous as to give it a velvety appearance. They are from four to ten millions in number. They collectively constitute the beginning of the absorbent or lacteal vessels of the intestine.

The *valvulæ conniventes* are transverse folds of the mucous membrane and underlying tissues found throughout a large extent of the small intestine. Their use is probably to retard somewhat the passage of alimentary mass, and and at the same time to offer a greater surface for absorption.

LIEBERKUHN GLANDS, crypts, are the simple or solitary glands of the intestine, also in large intestine. BRUNNER GLANDS (so-called from J. K. Brunner, 1653-1727), sometimes called duodenal glands, are small com-

PLATE CXLIV.



CIRCUMVALLATE PAPILLÆ.

pound glands of the duodenum and upper part of the jejunum, embedded in the submucous tissue, opening by minute orifices into the lumen of the intestine.

Then there are the SOLITARY LYMPH-NODULES, which are more frequently called solitary glands, though no more entitled to the name than the nodes which occur in the course of lymphatic vessels, having no secretive apparatus.

PEYER'S PATCHES are found in the lower ileum. They are oval, are from one-half to three inches in length, and about an inch in breadth. They are placed in long axis of the bowel. These patches were named after J. K. Peyer, a Swiss anatomist (1653-1712). A lesion of these patches is one of the most constant signs of typhoid fever.

LESSON XCII.

The **small intestine receives the blood** from the superior mesenteric artery, and a branch coming indirectly from the hepatic, the superior pancreaticoduodenalis. The superior mesenteric runs between the layers of the mesentery and gives off twelve or fifteen branches running downwards and to the left (*vasa intestini tenuis*,) which break up and form a series of arches, finally encircling the intestine as small branches. It also gives off a small branch at the

beginning, the inferior pancreatico-duodenalis, which, with the superior pancreatico-duodenalis, forms an arch which lies in the concavity of the duodenum and which supplies it.

The blood is returned by means of the superior mesenteric vein which, with the splenic forms the portal vein.

The **lymphatics** form a continuous series, which is divided into two sets—that of the mucous membrane and that of the muscular coat. The lymph-vessels of both sets form a copious plexus and end in the mesenteric lacteals.

The **nerve supply** of the small intestine is by means of the superior mesenteric plexus, which is continuous with the lower part of the solar plexus. The branches follow the blood vessels, and finally form two plexuses, one (Auerbach's) which lies between the muscular coats; and another (Meissner's) in the submucous coat.

The follicles of Lieberkuhn are found in the large and small intestine.

The **large intestine** (*intestinum crassum*) is about a quarter as long as the small intestine. It is called large on account of its diameter, being about two and a half inches in its broadest part. It begins at the right and lower portion of the abdomen, passes upward and backward to the under surface of the liver, thence across the belly to the spleen, from this point downward and forward to the left and lower part of the abdomen, here it makes a number of curves, and finally plunges into the pelvis at its back part, and ends close to the perineum, near the inner opening of the anal colon. Its divisions are the cæcum, ascending, transverse, descending colon, sigmoid flexure, and rectum.

The **glands of the small intestines** or mesenteric glands (100-150) lie between the layers of the mesentery among the meshes formed by the superior mesenteric vessels, their size varying from that of a pea to that of a small almond. They are largest and most numerous near the duodenum and the ileo-colic valve.

The **vessels of the small intestine** or lacteals, are of two kinds, viz., superficial, placed between the layers of the muscular coat, or between the muscular and peritoneal coats, and running longitudinally; and deep, placed in the submucous tissue and running transversely around the gut with the mesenteric vessels. They pass between the layers of the mesentery and then, in two or three large trunks, into the thoracic duct.

The cæcum lies in the right iliac fossa; from this point the ascending colon passes to the liver. Here it forms the hepatic flexure, then passes transversely across the belly below the stomach, and here the splenic flexure is formed, then it passes downward, forming the descending colon. In the left iliac fossa it forms the sigmoid flexure, and then passes through the pelvis as the rectum.

The large intestine has four coats with the same arrangement as the stomach and small intestine: serous, muscular, areolar, mucous.

The large intestine has the crypts of Lieberkuhn and solitary glands. It has no villi, no valvule conniventes, no glands of Brunner, no patches of Peyer.

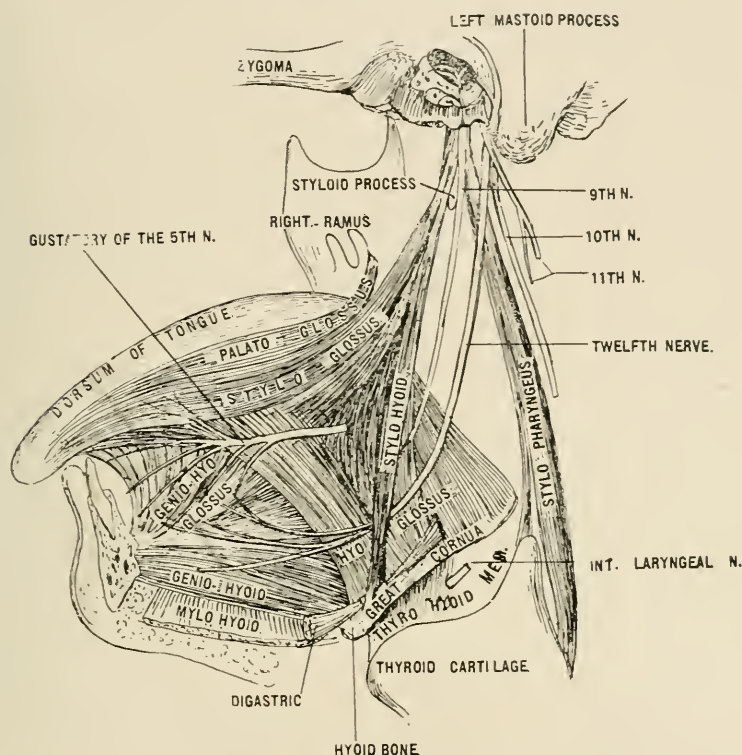
The **vermiform appendix** is a blind process given off from the cæcum, varying in man from three to six inches. (Plate CLIV.)

The opening of the small intestine into the large is provided with prominent lips which project into the cavity of the latter, and oppose the passage of

matter from it into the small intestine, while they readily allow of a passage the other way. This is the ileo-cæcal valve or valve of Bauhini.

The large intestine is supplied with blood by the branches of the superior

PLATE CXLV.



THE EXTRINSIC MUSCLES OF THE TONGUE.

mesenteric and inferior mesenteric arteries, while it also receives a blood supply from the internal iliac at the rectum. The vessels form a continuous series of arches from the cæcum, where the vasa intestini tenuis anastomose with the ileo-colic, the first branch of the superior mesenteric given to the large intestine. The blood supply of the rectum is from the inferior mesenteric by the superior hemorrhoidal, from the internal iliac, by the middle hemorrhoidal, and from the internal pudic by the inferior hemorrhoidal. The vessels at the lower end of the rectum assume a longitudinal direction, communicating freely at the anus and less freely above. The blood of the large intestine is turned into the portal vein by means of the superior mesenteric and inferior mesenteric veins. At the rectum a communication is set up between the systemic and portal system of veins, since some of the blood of that part of the intestine is returned into the internal iliac veins. In the lower end of the rectum the veins, like the arteries, are arranged longitudinally. This arrangement is called the hemorrhoidal plexus.

The nerves and lymphatics differ in no particular from those of the small intestine.

The **rectum** (*intestinum rectum*) extends from the sacro-iliac joint to the anus. It better deserves the name rectum (straight,) when we say it begins at the front of the third sacral vertebra, for then it is nearer straight. It has the same four coats that the intestine has. Its walls are thicker than those of the colon. The muscular coat and mucous coat differ from those of the outer portions of the canal. The peritoneum of the upper part of the rectum is thrown into folds called *appendices epiploicæ*. There are three semilunar transverse folds, one in the upper part of the rectum on the right side, another about the middle on the left side, and a third in front, opposite the base of the bladder. They are called the folds of Houston.

The **muscles of the rectum** are the *Sphincter ani*, *Internal sphincter*, and *Sphincter tertius* of Hyrtl. The rectum is supported by proper duplications of peritoneum, the *meso-rectum*, and other *fasciæ*.

LIVER.

The **Liver** (Plate CLIII) is the largest gland in the body, in the fetus it forms about one-third of its weight, and in the adult about one-thirty-sixth. It is situated in the right hypochondriac and epigastric regions and may extend over into the left hypochondriac region. It has three surfaces, viz., anterior, posterior, and inferior. It has three borders, viz., superior, inferior, and posterior; and two extremities. It is entirely covered with peritoneum.

It has in relation with it, (Plate CLII) **ABOVE**, the Diaphragm and anterior abdominal wall; **BELOW**, the cardiac end of the stomach, hepatic flexure of colon, right kidney, and first and second portions of the duodenum; **BEHIND**, the tenth and eleventh thoracic vertebrae, crura of Diaphragm, lower end of the œsophagus, right suprarenal capsule, and great vessels.

It has **five lobes**, (Plate CLXII) **five fissures**, **five vessels**, and **five ligaments**. Its lobes are the right, left, caudate, quadrate, and Spigelian. The ligaments are the coronary, the right and left lateral or triangular, the suspensory, broad or falciform, and the round ligament. The round ligament is the remains of the umbilical vein; all the other ligaments are folds of peritoneum. The vessels are the hepatic artery, hepatic veins, the bile ducts, lymphatic vessels, and the portal vein which breaks up into capillaries like an artery. Its fissures are the transverse, fissure for the gall-bladder, fissure for the inferior vena cava, ductus venosus, and the umbilical fissure.

The liver is made up of lobules which are about one-twelfth of an inch in diameter. The liver has various functions—it manufactures bile and sugar and has other metabolic functions. It is nourished by the hepatic artery which carries food to the cells and by the portal vein which carries raw material to be worked over by the cells.

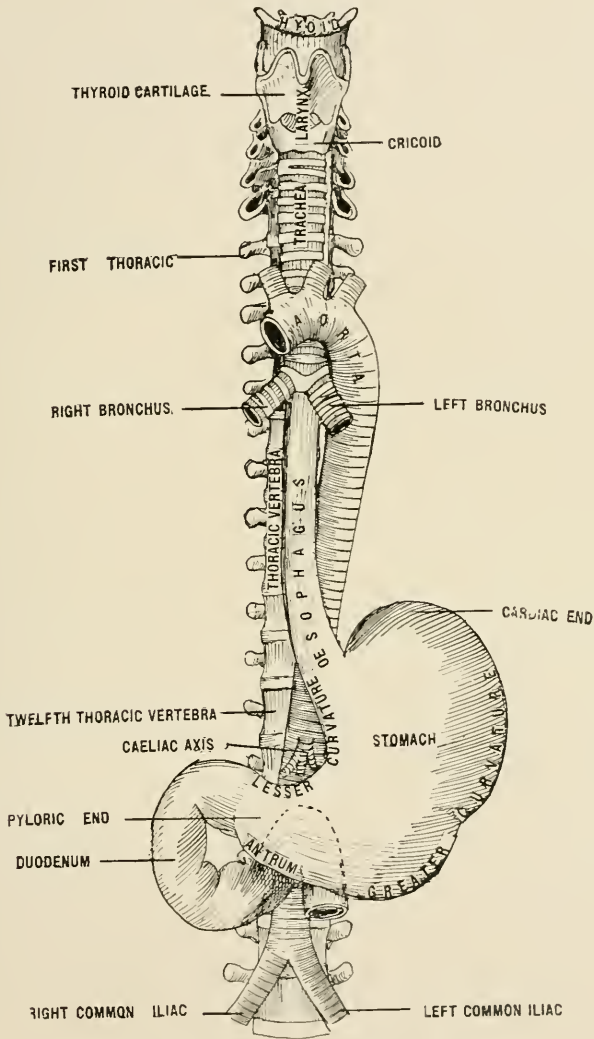
The **nerve supply** to the liver is from the hepatic plexus, which is an offset from the celiac plexus and receives filaments from the left pneumogastric and right phrenic.

The **portal veins** may be told from the hepatic as the portal veins remain

closed because they are surrounded by the capsule of Glisson while the hepatic veins gape open, being adherent to the liver substance.

The **gall-bladder** retains the bile and is situated between the right and

PLATE CXLVI.



THE ESOPHAGUS AND STOMACH.

quadrate lobes of the under surface of the liver. It is of pyriform outline, and when full is seen projecting beyond the anterior border of the liver, coming in contact with the abdominal wall opposite the ninth costal cartilage. It extends as far back as the transverse fissure. It is about three or four inches long and will hold about one and one-half ounces. The vessels of the gall-bladder are the cystic artery from the right branch of hepatic. Two cystic veins usually empty into the right branch of the portal vein, twelve or fifteen from the fundus

go directly into the liver. The nerves of the gall-bladder are from the cœliac plexus.

The **hepatic duct** is formed by the right and left bile ducts descending from the liver. The biliary ducts are the cystic ducts which come from the neck of the gall-bladder. It joins the hepatic forming the ductus communis choledochus. These three are called the biliary ducts. The ductus communis choledochus empties into the descending duodenum about three inches from the pyloric end of the stomach.

Pancreas means "all flesh," (Plate CXLVIII). In some of the lower animals it is known as the sweetbread. On account of closely resembling the parotid glands it is called the abdominal salivary gland. It is situated in front of the first and second lumbar vertebræ and behind the stomach. It has a head, a neck, a body and a tail. It varies considerably in size, it is about six inches long, from half an inch to one inch in thickness and weighs about three ounces. The pancreatic duct, also called the duct of Wirsung, extends the whole length of the pancreas and opens into the duodenum about three inches below the pylorus often in common with the ductus communis choledochus. The head or right extremity is surrounded by the curve of the duodenum, ductus communis choledochus, and the pancreatico-duodenalis arteries. The tail or left extremity lies above the left kidney and in contact with the lower end of the spleen.

LESSON XCIII.

The **pancreas** receives blood from the splenic artery through its pancreatic branches, and from the superior mesenteric and hepatic by the inferior and superior pancreatico-duodenalis arteries, which form a loop running round, below, and to the right of its head. The **blood** is returned into the portal vein by means of the splenic and superior mesenteric veins. The **lymphatics** terminate in two glands which lie on the superior mesenteric veins. The **nerve supply** of the pancreas is branches of the solar plexus which accompany the arteries entering the gland. Sometimes a lobe of the head is detached and has a duct of its own opening into the duodenum about an inch above the pancreatic duct. This lobe is called the lesser pancreas.

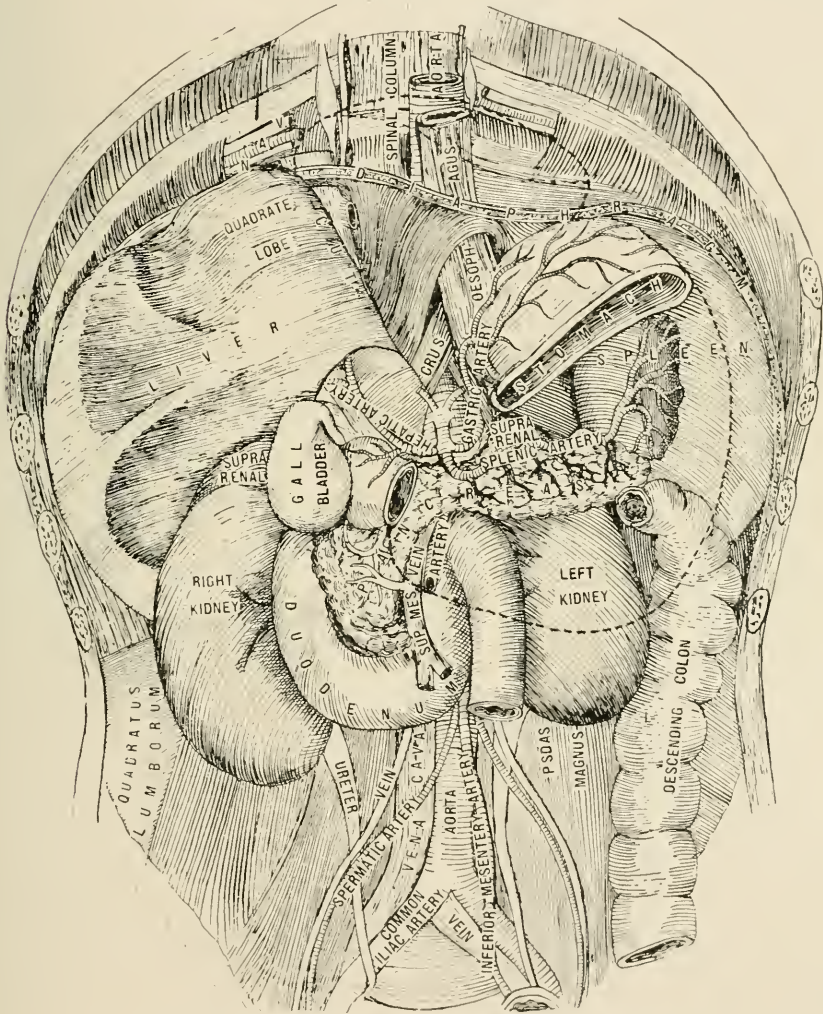
The **portal vein** (an appendage of the systemic system) is a single large trunk which carries venous blood from viscera to the liver; there it splits up into capillaries, which then unite to form the hepatic veins, which empty into the inferior vena cava.

The **portal system** (Plate CXXXVIII) consists of four large veins which drain the viscera of digestion and unite to form the portal vein; the branches correspond to those of the arteries, are always single, and have no valves. The four veins are the splenic, gastric, and superior and inferior mesenteric.

SUPERIOR MESENTERIC, ascends along the right side and in front of the artery, passes in front of the transverse duodenum, and joins with the splenic behind the upper border of the pancreas, forming the portal vein; it receives the pancreatico-duodenalis and right gastro-epiploic veins, and drains the cæcum, ascending and transverse colon, and small intestine.

SPLENIC, drains the spleen by several branches, which soon unite into one, this runs from left to right, below the artery, in a groove on the upper and back part of the pancreas and unites with the superior mesenteric at the greater end of the pancreas forming the portal vein. It receives the vasa brevia (gastric,) pancreatic, left gastro-epiploic and inferior mesenteric veins.

PLATE CXLVII.



SHOWING THE VISCERA BELOW THE DIAPHRAGM.

INFERIOR MESENTERIC, passes upward behind the transverse duodenum and pancreas to end in the splenic; drains the rectum, sigmoid flexure, and descending colon; and lies to the left of the artery; its hemorrhoidal branches inosculate with those of the internal iliac.

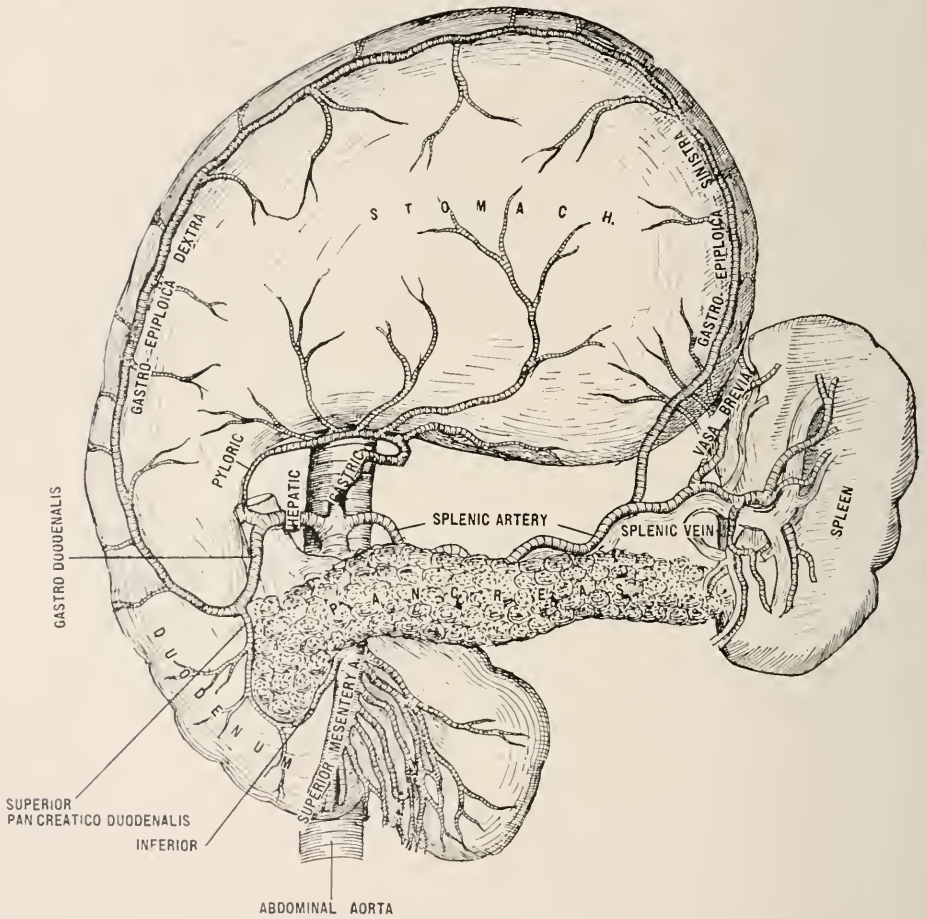
GASTRIC, two in number as follows: The pyloric, corresponding to the pyloric branch of the hepatic artery, runs on the lesser curvature towards the

pylorus, and ends in the portal vein. The coronary, corresponding to the gastric artery, runs on the lesser curvature toward the oesophagus, and then curves downward and backward in the lesser omentum to end in the portal vein.

Portal vein three or four inches long, begins behind the upper border of the right end of the pancreas by the union of the splenic and superior mesenteric.

It ascends in the right border of the lesser omentum, between and behind the

PLATE CXLVIII.



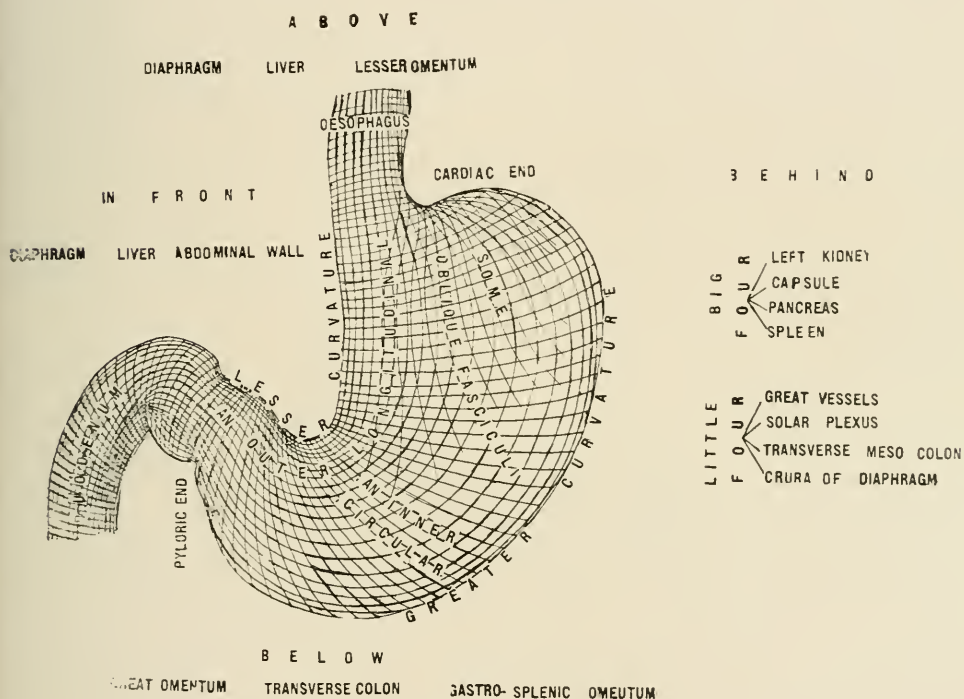
SHOWING BLOOD SUPPLY OF STOMACH.

hepatic artery (to the left) and duct (to the right,) enters the transverse fissure of the liver, and becomes a dilated (sinus); it then divides into two branches (the right is larger but shorter) which enter the two main lobes of the liver and split up. It receives the gastric and cystic veins, the latter from the gall-bladder.

The vessels of the liver form two sets: The **superficial vessels** arise, over the entire surface, in the subperitoneal areolar tissue. Those on the convex surface form four groups, viz., (1) three or four branches which run forward

and then upward in the longitudinal ligament, and, as a single trunk, through the Diaphragm to the anterior mediastinal glands and thence to the right lymphatic duct; (2) branches which run forward and around the anterior margin to the under surface, and thence in the longitudinal fissure to glands in the lesser omentum; (3) branches which pass outward to the right lateral ligament and thence, coalescing, either through the Diaphragm to the anterior mediastinal glands, or inward, across the crus, to the thoracic duct; and (4) branches which

PLATE CXLIX



SHOWING THE MUSCULAR COATS AND RELATIONS OF THE STOMACH.

run outward from the left lobe to the left lateral ligament, and thence through the Diaphragm to the anterior mediastinal glands.

Those on the under surface form three groups, viz., (1) branches arising to the right of the gall-bladder and passing to the lumbar glands; (2) branches surrounding the gall-bladder in a plexus and passing, with the hepatic vessels to glands in the lesser omentum; and (3) branches arising to the left of the gall-bladder and passing to the œsophageal glands or glands along the lesser curvature of the stomach.

The **deep vessels** of the liver accompany the branches of the portal vein and hepatic duct and artery; they escape at the transverse fissure and either enter glands placed along the lesser curvature or the stomach and behind the pancreas, or join a lacteal before it enters the thoracic duct.

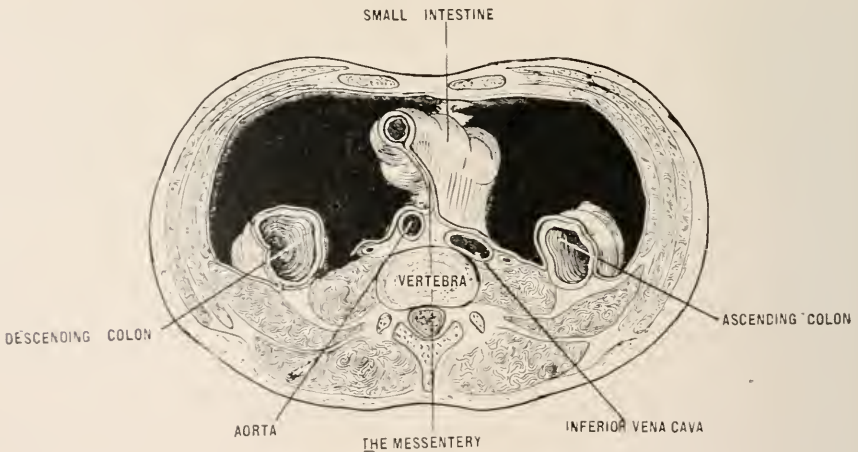
LESSON XCIV.

SPINAL CORD. (Plates IV-V-CXCII-CXCIII-CXCIV).

The **spinal cord** belongs to the **CEREBRO-SPINAL** or **CENTRAL NERVOUS SYSTEM**, which consists of the **brain** and **spinal cord**. The **twelve pairs** of cranial nerves, and **thirty-one pairs** of spinal nerves make the **PERIPHERAL SYSTEM**. Besides these two systems there is the **SYMPATHETIC SYSTEM** which is connected with these two and closely associated with the vessels, viscera, and glands.

The **spinal cord** extends from the level of the foramen magnum (below the decussation of the pyramids of the medulla) to the level of the upper border of the second lumbar vertebra, sometimes only to the first lumbar vertebræ. Its length is from fifteen to eighteen inches and its average weight about one and one-half ounces. It is a somewhat flattened cylinder, wider in the transverse diameter. It follows the curves of the spinal column in which it is lodged. It is composed of **white** and **gray matter**, the white on the exterior, and the gray on the interior. The **gray matter** of the cord consists of two kinds, (1) **SUBSTANTIA GELATINOSA** (**ROLANDI** and **CENTRALIS**) and (2) **SUBSTANTIA SPONGIOSA**. **Rolandi** forms a cap to the posterior horn. It extends the **WHOLE LENGTH OF THE CORD** into the **MEDULLA** where it becomes enlarged and has large

PLATE CL.



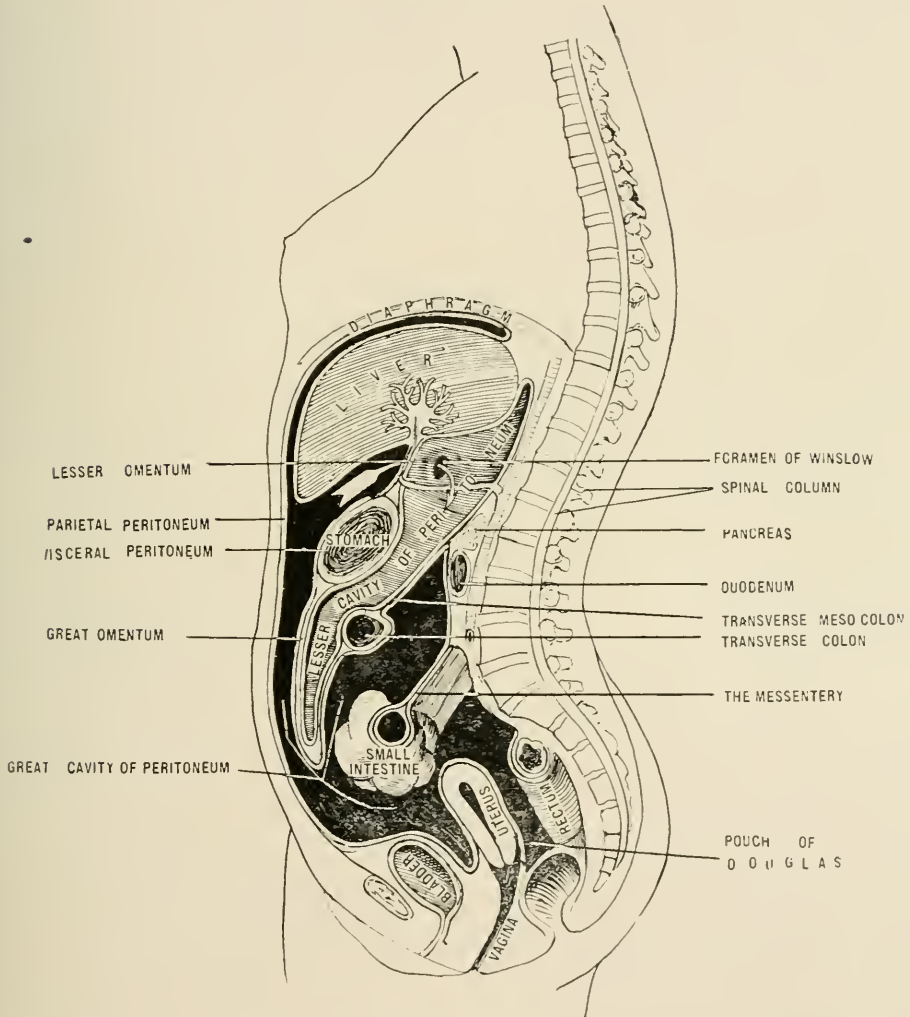
SHOWING THE PERITONEUM AS A CLOSED SAC.

nerve cells and forms one of the **END STATIONS** for the sensory divisions of the fifth nerve. The **substantia gelatinosa Rolandi** was formerly thought to be rich in **neruoglia** tissue, but in fact it is **VERY POOR** in this tissue. The **cord** has **two enlargements**, the **CERVICAL** and the **LUMBAR**. The **former** is between the third cervical and the second thoracic vertebra, reaching its greatest diameter, which is transverse, in the sixth cervical. The **latter** is between the ninth thoracic and first lumbar; its greatest diameter, which is antero-posterior, is opposite the twelfth thoracic vertebra. These enlargements occur where the nerves are given off to supply the extremities. As the cord is **shorter** than the canal, the lumbar, sacral, and coccygeal nerve roots have a longer course than the nerve

roots above them. The last nerve roots have the appearance of A HORSE'S TAIL (*cauda equina*).

The **neuroglia** consists of a homogenous transparent matrix of a network of very (1) delicate fibrillæ, and of (2) small stellate or branched cells, the neuroglia cells. Formerly it was considered connective tissue but neuroglia

PLATE CLI.



A SAGITTAL SECTION OF THE TRUNK SHOWING THE PERITONEUM.

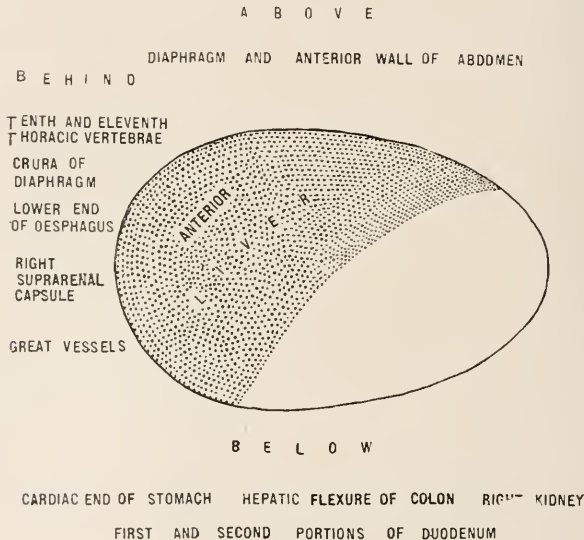
is developed from the **epiblast** and connective tissue from **mesoblast**. In addition to forming a GROUND SUBSTANCE in which the nerve fibers, nerve cells, and blood vessels are imbedded, a considerable accumulation of neuroglia takes place in these situations; (1) ON THE OUTER SURFACE OF THE CORD, beneath the pia mater, (2) AROUND THE CENTRAL CANAL, and (3) IN THE ANTERIOR HORN.

The **conus medullaris** is the cone-like termination of the cord, and this

terminates in a slender thread, THE FILUM TERMINALE. The **filum terminale** is a continuation of the pia mater as far as the base of the coccyx, to the periosteum of which it is attached. It contains very little nervous matter, and is distinguished from the nerves of the cauda equina by its glistening white appearance.

The **membranes of the cord** are the same as those of the brain, viz., dura mater, arachnoid, and pia mater. The **dura mater of the cord** differs from that of the brain, in that it does not form (1) THE INTERNAL PERIOSTEUM, does not adhere (2) TO THE WALLS, does not contain (3) SINUSES, and does not send (4) INFOLDINGS INTO THE FISSURES OF THE CORD. The **nerve supply** of the dura mater is from the spinal nerves and filaments from the sympathetic. The dura mater of both brain and cord send TUBULAR PROLONGATIONS over the nerves.

PLATE CLII.



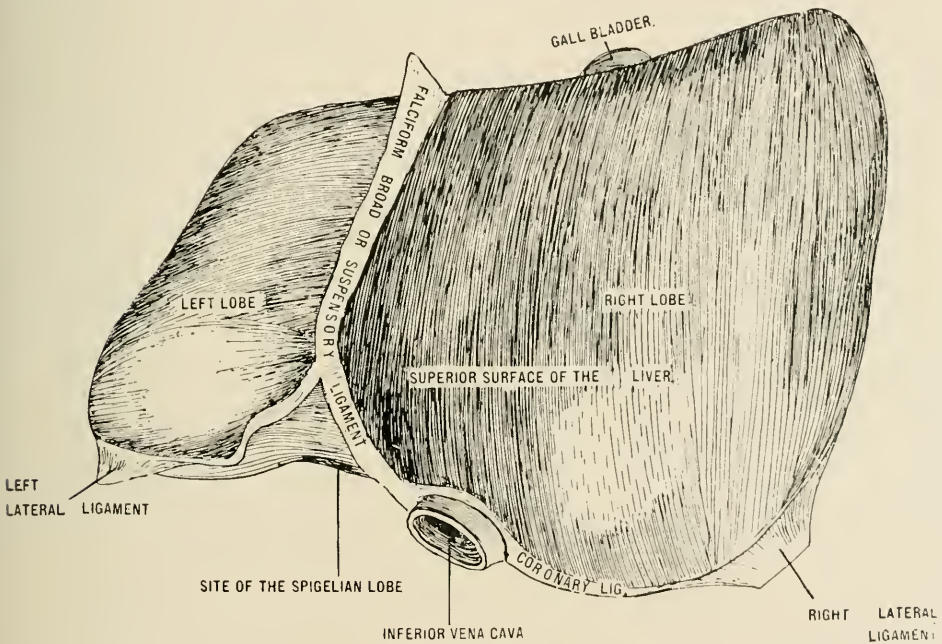
THE RELATIONS OF THE LIVER.

It is separated from the walls of the spinal canal by fat, loose areolar tissue, and anterior and posterior plexuses of veins. It is attached above to THE FORAMEN MAGNUM, to THE AXIS and THE THIRD CERVICAL VERTEBRA, and below to THE POSTERIOR SURFACE OF BASE OF THE COCCYX. The **subdural space** is between the dura mater and the arachnoid and contains a small quantity of cerebro-spinal fluid. The inner surface of the dura mater is lined with endothelium, and is abundantly supplied with nerves and blood vessels.

The **arachnoid of the cord** is more delicate than that of the brain, but resembles it in sending tubular prolongations over the nerves. It is **devoid of nerves** and has but a slight **blood supply**. It extends as far as the second or third sacral vertebra. It forms a long sac and the space between it and the pia mater is called the subarachnoid space. This space contains cerebro-spinal fluid, which is about one ounce in this space and two ounces in the ventricles.

The **pia mater** is the inner membrane of the cord. It is closely adherent to the cord and sends septa into the anterior and posterior fissures of the cord. The **linea splendens** is the thickened line of pia mater along the anterior median line. The **ligamenta denticulata** are fibrous bands which are attached to the median lateral aspect of the pia mater from the level of the foramen magnum to the level of the first lumbar vertebra. The ligaments are midway between the anterior and posterior nerve roots. There are about **twenty-one ligaments** on each side, extending from the pia mater to the dura mater, carrying the arachnoid along which it, not piercing it. The highest one of the processes is placed between the hypoglossal nerve and the vertebral artery.

PLATE CLIII.



THE SUPERIOR SURFACE OF THE LIVER.

The **reticula** is a network of gray matter, enclosing white fibers in its meshes. It is situated at the base of the posterior horn externally, directly opposite the columns of Clarke. The **columns of Clarke** are two symmetrically placed tracts of medium sized nerve cells of the spinal cord, latero-dorsal of the central canal, confined chiefly to the dorsal region, but also extending a little above and below it.

LESSON XCV.

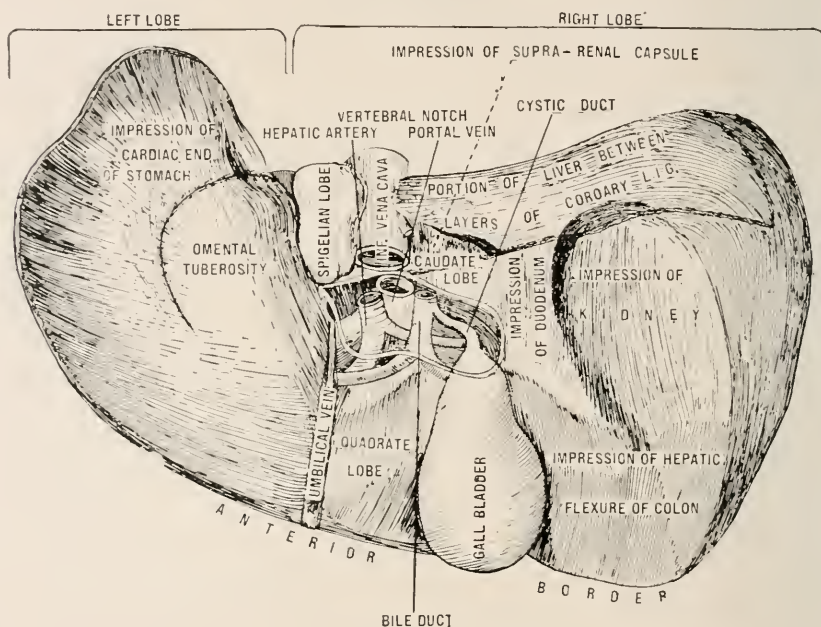
The **anterior** and **posterior nerve roots** of the spinal cord emerge from the antero-lateral and postero-lateral aspects of the cord respectively, and form a double row on each side of it. The anterior roots arise from the anterior horn of the gray matter and contain motor fibers; the posterior roots arise from the posterior horn and contain sensory fibers.

The **central canal** is in the centre of the gray commissure, and is lined with

columnar ciliated epithelium in the fetus, but in the adult the cilia have disappeared and fill the canal with their remains. It is continuous above with the fourth ventricle of the brain. This canal is the remains of the original neural canal of the embryo, from the walls of which the spinal cord is formed. The *sinus rhomboidalis inferior* or *ventricularis terminalis* is a dilatation of the central canal in the *conus medullaris*.

Diseases of the spinal cord may affect its entire transverse area, or certain portions of it in varying lengths, or it may begin at any level and extend upward or downward, in which case, being designated as ascending or descending.

PLATE CLIV.



THE INFERIOR SURFACE OF THE LIVER.

A **tumor** would be an example of a focal disease, or disease of one of the segments (a portion of the cord with a pair of nerves). **Locomotor ataxia** is an example of a systemic disease.

Fractures of the spinal column above the fifth cervical vertebra—above the origin of the phrenic nerve, are almost always fatal because of paralysis of the diaphragm. **Fractures** of the fifth, sixth, and seventh vertebræ cause paralysis of the intercostal and abdominal muscles and death usually results. In **fractures** of the lower part of the thoracic region the prognosis is not so unfavorable. **Degenerations** in motor tracts of the cord descend, and the sensory tracts ascend. This is due to the fact that the **trophic centers** of the motor tracts are in the GRAY MATTER OF THE BRAIN, while those of the sensory tracts are in the GANGLIA UPON THE POSTERIOR ROOTS of the spinal nerves. In the **crossed pyramidal tracts** we find three sets of fibers, motor, vasomotor,

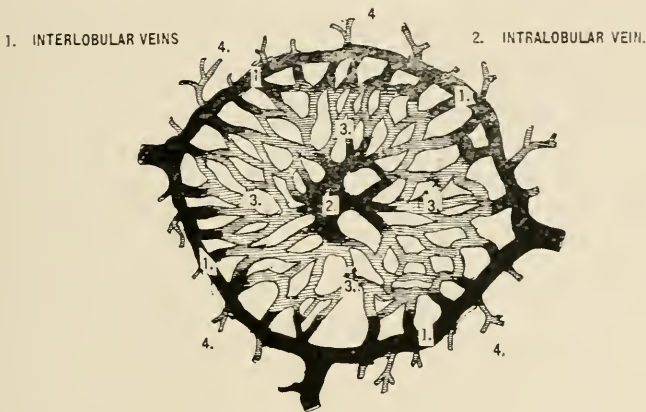
and fibers which carry impulses for inhibition of reflex action. The vasomotor and inhibitory fibers pass to the motor cells of the anterior horn. When the crossed pyramidal tract degenerates these inhibitory and vasomotor fibers are included, and dilatation of the blood vessels and increased reflexes result.

In *spina bifida* there is an overabundance of cerebro-spinal fluid with faulty development of the posterior walls of the lumbar portion of the spinal canal. In this condition the membranes are pushed through the opening in the spinal canal by the weight of the cerebro-spinal fluid.

The **subarachnoid spaces of the cord and brain** are continuous and connected

PLATE CLV.

3. PLEXUS OF CAPILLARY BLOOD-VESSELS WITHIN THE LOBULE.



4. TWIGS OF INTERLOBULAR VEIN, PASSING TO THE ADJACENT LOBULES.

THE VESSELS OF A LOBULE OF THE LIVER.

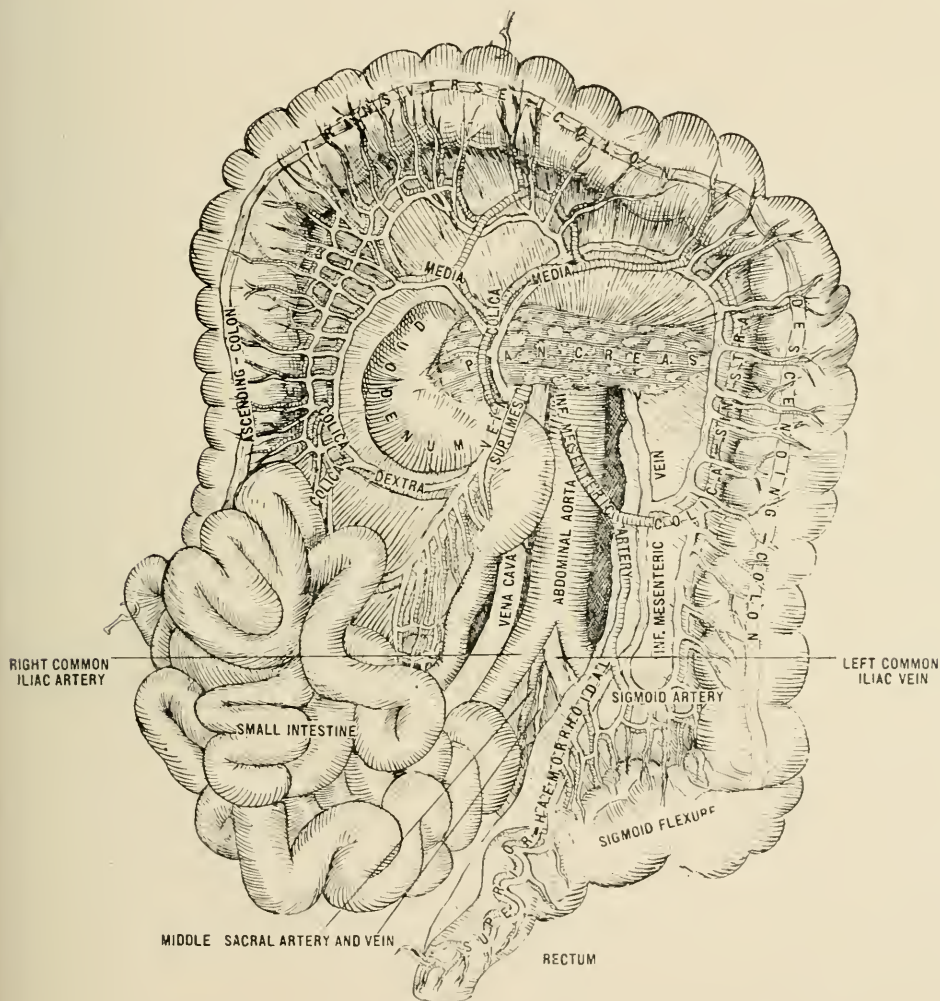
with the fourth ventricle by the foramina of MAGENDIE, KEY, and RETZIUS. The opening of a *spina bifida* may drain the cerebro-spinal fluid from the brain and result in fatal convulsions.

The **fissures of the cord** are antero-median, postero-median, two antero-lateral, two postero-lateral, and two dorso-intermediate fissures. These fissures divide the cord into eight columns, viz., ventral, lateral, "Goll. and Burdack (posterior.)" These are on each side.

The **ascending and descending fibers** of the white matter of the cord are arranged in tracts, but these tracts are not recognizable in the adult cord, but only during development or when affected with disease or degeneration. The facts concerning the tracts have been ascertained by embryological and pathological research. This division of fissures is somewhat arbitrary, as the place where the anterior nerve roots leave the cord is not always called a fissure, and the dorso-intermediate one is only in the cervical region. If we take this division there are only eight fissures and eight columns in the spinal cord. The antero-median fissure extends about one-third the diameter of the cord, toward

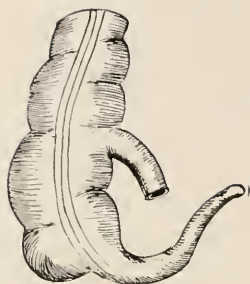
the lumbar, and from the internal iliac arteries. (2) From the anterior and posterior spinal branches of the vertebral arteries. The **anterior spinal arteries** are two in number; and come from the vertebrals, just before they unite to make the basilar at the foramen magnum, the anterior spinals unite to make one artery, the anterior median artery. This artery lies in the pia mater, which it

PLATE CLVII.

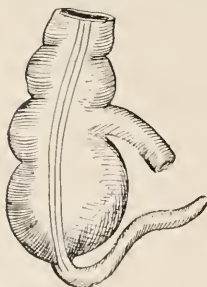


SHOWING THE BLOOD SUPPLY TO THE LARGE INTESTINE.

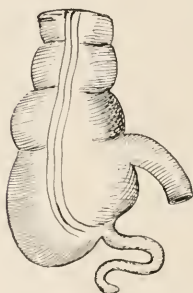
supplies, and extends the whole length of the cord. It receives branches from the lateral spinal arteries, and it sends branches into the substance of the spinal cord. The **posterior spinals** are also two in number; they come from the vertebral arteries at the side of the medulla (occasionally from the posterior inferior cerebellar); they pass down behind the posterior nerve roots (occasionally there is another branch in front of the posterior nerve roots) to the cauda equina. Each seg-



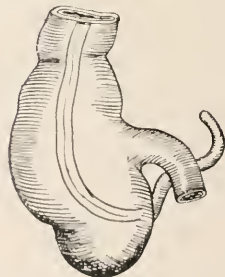
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NO. 3.



NO. 4.



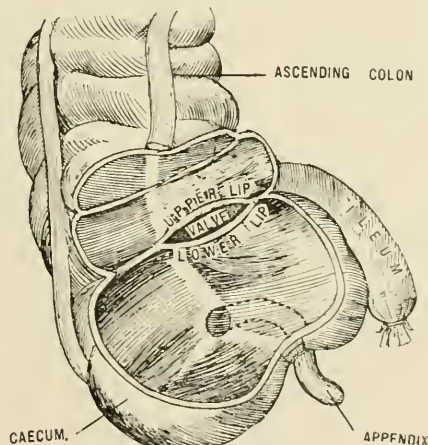
ment (a part of the cord with a pair or nerves) has a blood supply which is made by the anterior and posterior spinal, reinforced by the lateral spinal, making a ring around the segment. Branches are given from each segment to the segment above and below. The **blood supply of the vertebral column** and its ariculation is the vertebral, occipital, ascending pharyngeal, ascending cervical, intercostal, lumbar, ilio-lumbar, sacra media, and lateral sacral. The **nerve supply** is from the spinal nerves.

LESSON XCVI.

BRAIN. (Plates CLXVIII -CLXXXIII.)

There is but **one nervous system**, consisting of three great divisions. The **brain** and **spinal cord** make the **CENTRAL SYSTEM**, the **twelve pairs of cranial** and the **thirty-one pairs of spinal nerves** make the **PERIPHERAL SYSTEM**, and the **third division** is called **THE SYMPATHETIC SYSTEM**. This last system is called

PLATE CLIX.



THE ILEO-CÆCAL VALVE.

the nerve of organic life while the central one is called the nervous system of animal life. The specific gravity of the nervous system is 1.036, the brain 1.038 and the spinal cord 1.034. The reaction is alkaline, which is lessened by activity, owing to lactic acid being developed. The white matter is more alkaline than the gray. The brain is a collection of gray ganglia connected by white commissures.

The following are the principal transverse commissures:

1. Anterior commissure.
2. Middle commissure.
3. Posterior commissure.
4. Corpus callosum.
5. Optic commissure.
6. Pons Varolii.

7. Fornix, which is a longitudinal commissure also.
8. Posterior or inferior medullary velum.
9. Valve of Vieussens, anterior or superior medullary velum.

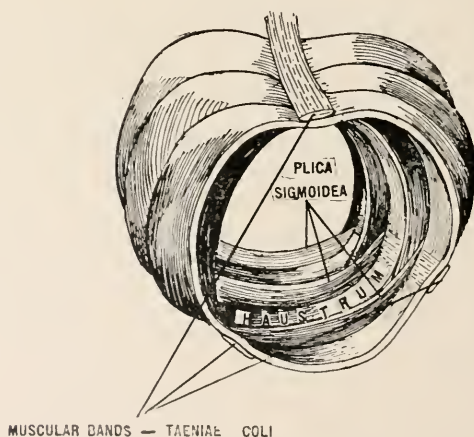
The following are the principal longitudinal commissures:

1. Olfactory tracts.
2. Tænia semicircularis.
3. Crura cerebri.
4. Processus-c-cerebello ad testes.
5. Peduncles of the pineal gland.
6. Fornix.
7. Infundibulum.
8. Lamina Cinerea.
9. Gyrus fornicatus.
10. Fasciculus unciformis.

LESSON XCVII.

The **extensor of the brain**, which is called **cortex**, is **GRAY**, while the interior is white. The average weight of the brain is **FORTY-NINE** and **ONE-HALF-OUNCES** in the male, while it is a little lighter in the female.

PLATE CLX.



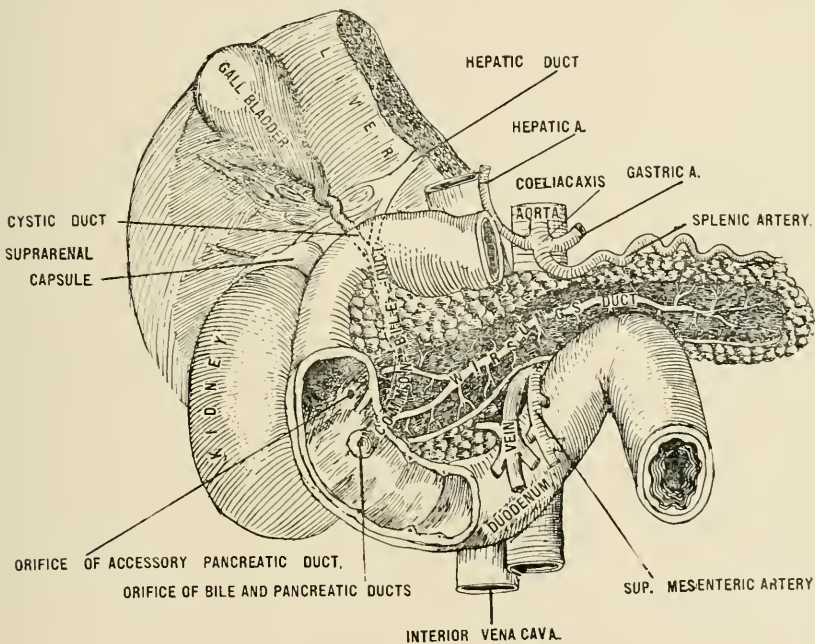
TRANSVERSE SECTION OF THE LARGE INTESTINE.

The **nervous system** is developed from the neural tube. (Plates CLXIV-CLXV-CLXVI-CLXVII). The substance of the brain and cord are made from a thickening of the walls of the tube; the hollow of the tube makes the central canal of the cord and the ventricles of the brain. The **rooms**, or **ventricles** in the brain are filled with cerebro-spinal fluid which acts as a cushion for the brain and cord. There are **five ventricles** in the brain. The central canal in the cord is dilated as it passes into the brain, between **THE CEREBELLUM** BEHIND, and **THE PONS** AND **MEDULLA** IN FRONT; this dilatation is called the **fourth ven-**

tricle; as this passage goes forward between THE CRURA CEREBRI IN FRONT, and THE CORPORA QUADRIGEMINA BEHIND, it is contracted and is called the **aqueduct of Sylvius** (iter e tertio ad quartum ventriculum); from here it passes into a narrow but high room, called the **third ventricle**, which is BETWEEN THE OPTIC THALAMI; these two ventricles are in the median line of the brain. There are TWO LATERAL VENTRICLES, one in each hemisphere, which are connected with the third one by the foramen of Monro. There is the **fifth ventricle** not connected with the others; it is situated in THE SEPTUM LUCIDUM.

The **brain** consists of four main parts, (1) fore-brain, (2) inter-brain, (3) mid-brain, and (4) hind-brain. The brain is called **encephalon**; the cerebral

PLATE CLXI.



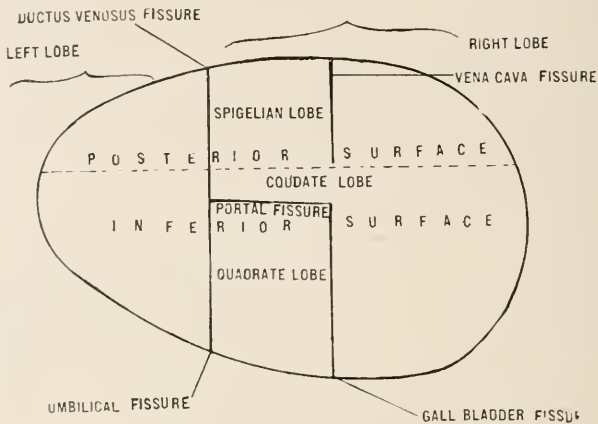
PANCREAS, DUODENUM AND KIDNEY.

hemispheres are called **prosencephalon**; the parts around the third ventricle are called the **thalamencephalon**; the parts around the aqueduct of Sylvius are called the **mesencephalon**; the pons and cerebellum, are called the **epencephalon**; the medulla is called the **metencephalon**; the olfactory tract is called the **rhinencephalon**. The spinal cord is called the **myelon**. The **encephalon** and the **myelon** constitute the **neuron**. The brain, like the spinal cord, has three coats, viz., dura mater, arachnoid, and pia mater. The **arteries** which supply the dura mater are derived chiefly from the anterior, middle, and posterior meningeal. The **nerve supply** of the dura mater is the sympathetic, Gasserian ganglion, fourth, fifth, tenth, and twelfth. The **arachnoid** has but a limited blood supply, and the nerve supply is from the motor division of the fifth, the seventh, and the spinal accessory. The **pia mater** receives blood supply from the ni-

ternal carotid and vertebral arteries. The nerve supply is from the sympathetic, the third, fifth, sixth, seventh, ninth, tenth, and eleventh cranial nerves.

The **exterior of the cerebrum** is uneven, having hills and valleys. The hills are called **gyri**, or **convolutions**; the valleys are called **sulci**, or **fissures**. The larger fissures are called **PRIMARY**, the others **SECONDARY**. The primary are either **COMPLETE** or **INCOMPLETE**. A **complete fissure** makes an impression in a ventricle of the brain. They are all on the mesial surface of the brain. They are (1) the **dentate**, which makes the hippocampus major in the descending horn; (2) the **calcarine**, which makes the hippocampus minor in the posterior

PLATE CLXII.



LOBES AND FISSURES OF THE LIVER.

horn; and (3) the collateral, which makes the eminentia collateralis in the descending horn. There are two others which are sometimes called complete fissures, the transverse, which has opposite it the choroid plexus, and the fissure of Sylvius, which has opposite it the corpora striata. The last two are not on the mesial surface.

LESSON XCVIII.

The right and left lobes of the cerebrum are connected by THE CORPUS CALLOSUM. There are FIVE LOBES in each hemisphere of the brain.

The **brain** is the encephalon; the part of the cerebro-spinal axis which is contained in the cranium. Its divisions are the cerebrum or **brain proper**, the **cerebellum** or **little brain**, the **pons Varolii**, and the **medulla oblongata**. The average weight of the brain in the male is forty-nine and one-half ounces, in the female forty-four ounces. Cuvier's brain weighed more than sixty-four ounces. The **human brain** weighs more than that of any other animal, except the elephant and whale. The elephant's brain weighs about ten pounds; that of the whale five pounds.

Like the bark (cortex) of a tree the cortical layer of the brain covers the surfaces of the brain. It is composed of cellular nerve-material.

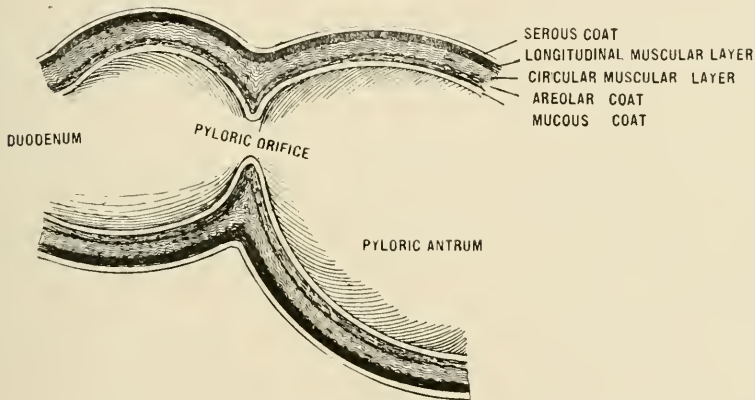
The **fissures** or **sulci** of the brain are infoldings of the cortex and the more numerous and deeper they are, the greater is the amount of the peripheral gray substance.

The gray matter of the brain which invests the cerebellum and cerebrum, is also called the cortical substance, in distinction from the white or medullary substance of the interior. There are several ganglia or collections of gray matter in the interior, as THE CORPORA STRIATA, the OPTIC THALAMI, THE OPTIC LOBES or CORPORA QUADRIGEMINA, THE CORPORA DENTATA of the cerebellum, and THE CORPORA OLIVARIA of the medulla oblongata. There are TWO NON-NERVOUS STRUCTURES connected with the brain, the **conarium** or **epiphysis cerebri** and the **pituitary body** or **hypophysis cerebri**.

THE PRINCIPAL FISSURES OF THE CEREBRUM ARE: (Plates CLXXV-CLXIX).

(a) The longitudinal fissure which separates the two hemispheres.

PLATE CLXIII.



THE FOUR COATS OF THE STOMACH AND THE PYLORIC ORIFICE.

(b) The Sylvian fissure is the largest, deepest, and most constant of the fissures of the brain. It has a short anterior and long posterior branch, the latter separating the temporal from the parietal lobes. It has the middle cerebral artery in it, lesser wing of sphenoid and central lobe or isle of Reil.

(c) The fissure of Rolando or central fissure is a deep sulcus separating the frontal and parietal lobes of the cerebrum on each side.

(d) Parieto-occipital fissure extends from the longitudinal fissure outwards for about one inch between the parietal and occipital lobes.

(e) The transverse fissure is a crevice through which the invagination of the pia mater is effected, it starts from the porta (foramen of Monro) nearly to the distal end of the middle horn on each side. It is at the base of the brain. It is also called choroid fissure.

(f) Calloso-marginal fissure is nearly concentric with the callosal and also with that of the margin of the hemisphere until a point above the hind end of the callosum is reached, at which the fissure turns and runs upward and backward to the upper border.

(g) Calcarine fissure (from calcar, "a spur"), runs from near the rather pointed hind end of the hemisphere upward and forward, and just beyond the middle, at the point where it receives the parieto-occipital, binds downward and terminates beneath the rear end of the callosum. Encircling the callosum is a fissure, called the callosal.

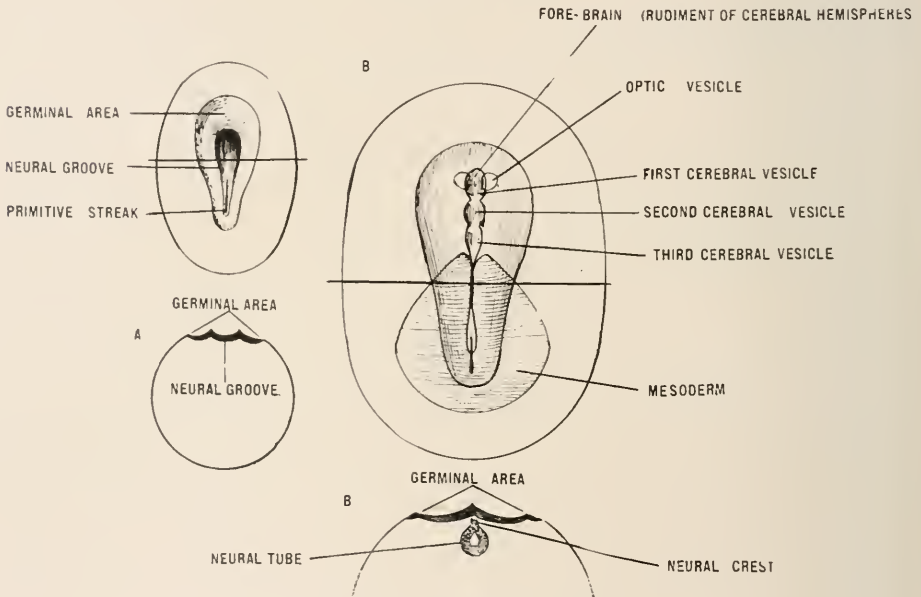
(h) First temporo-sphenoidal fissure is below the fissure of Sylvius on the lateral surface of the brain.

LESSON XCIX

THE PRINCIPAL LOBES OF THE CEREBRUM ARE: (Plates CLXXV).

1. Frontal lobe is the anterior one of the cerebrum, separated from the parietal by the fissure of Rolando or central fissure.
2. Parietal lobe is the middle one of the vault of the cerebrum, separated

PLATE CLXIV



SHOWING GERMINAL AREA.

from the frontal by the central fissure, or fissure of Rolando and marked off from the occipital by the parieto-occipital fissure. It is divided by an intra-parietal fissure into a superior and inferior parietal lobe.

3. Occipital lobe is the posterior portion of the cerebrum marked off from the parietal lobe by the parieto-occipital fissure.

4. Temporo-sphenoidal lobe, also called temporal, is the lobe of cerebrum which occupies the middle cerebral fossa of the skull, it is separated from the frontal and parietal lobes by the fissure of Sylvius.

5. The Central lobe or island of Reil is also called the lobule of the Sylvian fissure, lobule of the corpus striatum, is a portion of the cerebral cortex con-

cealed in the Sylvian fissure, consisting of five or six radiations, convolutions, or the gyri operi ("covered gyrus").

Different human brains vary in details of the gyri, and the same brain may differ on its opposite sides. The gyri are best marked when one reaches his highest mental development.

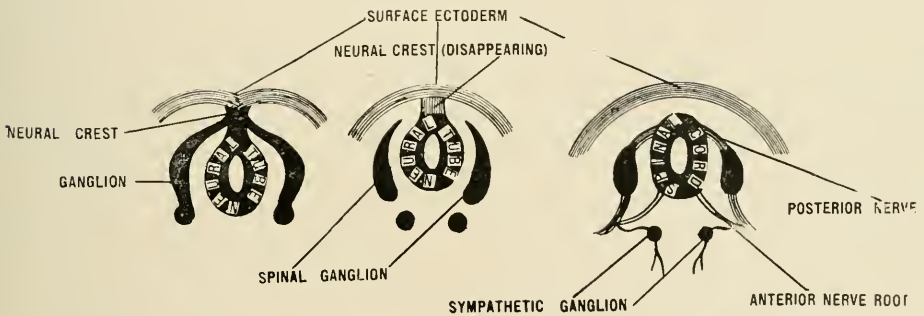
THE PRINCIPAL GYRI OR CONVOLUTIONS ARE: (Plate CLXXV-CLXXXIII-CLXXXIV).

1. Angular gyrus is a short one, arching over the upper extremity of the superior temporal fissure, the hindmost one of the four parietal gyri, separated by a short vertical sulcus from the supra-marginal gyrus.

2. Annectent gyrus is a small fold which may connect large or primary convolutions; applied to several such gyri on the occipital lobe, as those forming the connections of the cuneus or occipital lobule.

3. Ascending frontal gyrus is the one bounding the fissure of Rolando in front.

PLATE CLXV.



SHOWING THE DEVELOPMENT OF THE SYMPATHETIC NERVE.

As ascending parietal is the one bounding the fissure of Rolando behind.

5. Calossal gyrus is a convolution of the median surface of the cerebrum immediately over the corpus callosum and below the calloso-marginal fissure. It is continuous behind with the gyrus hippocampi, and ends in the gyrus uncinatus, also called gyrus fornicatus, convolution of the corpus callosum.

6. Cuneate gyrus is one of the occipital lobe appearing as a wedge-shaped figure on the median aspect of the cerebrum in the fork between the parieto-occipital sulcus and the calcarine sulcus, also called occipital lobule and cuneus.

7. External orbital gyrus is that part of the orbital surface which lies outside of the triradiate sulcus.

8. The frontal gyri, three gyri which compose the superior and lateral surface of the frontal lobe of the cerebrum, all lying in front of the ascending frontal gyrus. They are defined by the superior and inferior frontal sulci, and by the vertical fissure or precentral sulcus.

9. The hippocampal gyrus is the continuation of the gyrus fornicatus where it dips down behind and below the corpus callosum, and continues forward to the uncinatus gyrus; so-called from its relation to the hippocampus.

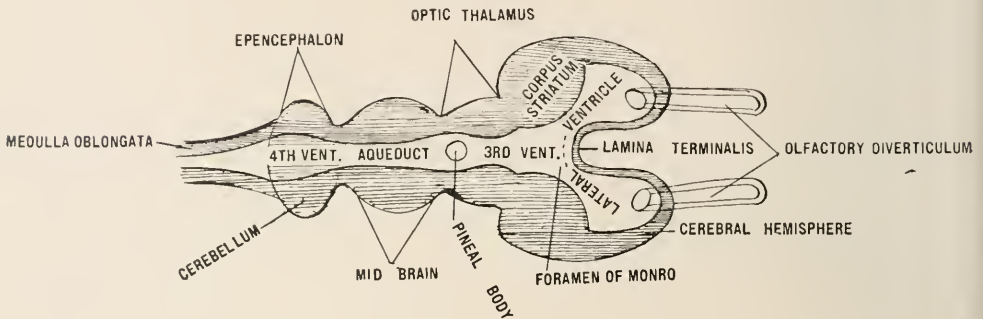
10. That part of the first frontal convolution which appears on the median side of the hemisphere is the marginal gyrus, or it is that gyrus which arches over the extremity of the fissure of Sylvius.

11. Occipital gyri are the three principal convolutions of the occipital lobe of the cerebrum, separated by two small transverse sulci, and distinguished as first, second, and third; from above downward, superior, middle, and inferior.

12. The orbital gyri are upon the under or orbital surface of the frontal lobe of the cerebrum, which rest upon the orbital plate of the frontal bone. They are three in number, directly continuous with and corresponding to the frontal gyri. The two which are best marked are sometimes called internal and external.

13. The parietal gyri are four well-marked convolutions upon the superior

PLATE CLXVI.



A HORIZONTAL SECTION OF A VERTEBRATE BRAIN.

and lateral surface of the parietal lobe; and especially two of these distinguished as the ascending parietal or posterior central and the superior parietal, the other two being commonly known as the supramarginal and angular gyrus.

14. Quadrate, or quadrate gyrus, is a convolution of somewhat square figure appearing on the median surface of the cerebrum between the callosum marginal sulcus in front and the parieto-occipital sulcus behind, and continuous below with the gyrus fornicatus, also called precuneus.

15. Sigmoid gyrus is the somewhat S-shaped fold which curves about the lateral end of the cruciate fissure and whose surface includes several constant and well-marked "motor areas."

16. The temporal gyri, a general name of the temporal convolutions.

17. Uncinate gyrus is in the median surface of the cerebrum nearly opposite the gyrus fornicatus.

18. Gyri operi ("covered gyrus") is the insula.

19. The dentate gyrus is lodged in the hippocampus fissure, and is a long slender roll of gray substance, notched upon its exposed surface.

LESSON C.

Besides the gray matter of the cerebral hemispheres of the cerebellum and the medulla oblongata, and the ganglia at the base of the brain are:

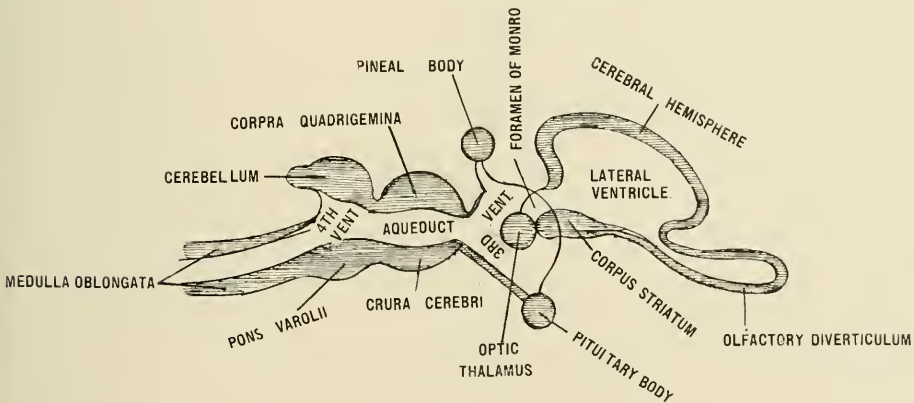
(a) Olfactory bulb which is the anterior enlargement of the olfactory tract from the which olfactory nerves are sent off.

(b) Corpora striata (striped bodies) are large ganglia of the brain, of mixed white and gray substance, situated beneath the anterior horn of each lateral ventricle of the cerebrum.

(c) Optic thalamus is a large ganglion of the thalamencephalon, situated upon the crus and separated from the lenticular nucleus by the internal capsule; also called thalamus. It gives origin to some of the fibers of the optic nerve.

(d) Tubercula quadrigemina are on the dorsal part of the mid-brain. The lobes are paired, right and left, and hence called corpora bigemina in ani-

PLATE CLXVII.



A SAGITTAAL SECTION OF A VERTEBRATE BRAIN.

mals below mammals. In man they are marked by a cross-furrow so they are called corpora quadrigemina, and constitute what are called the nates or testes of the brain. The optic nerve arises in part from the optic lobes.

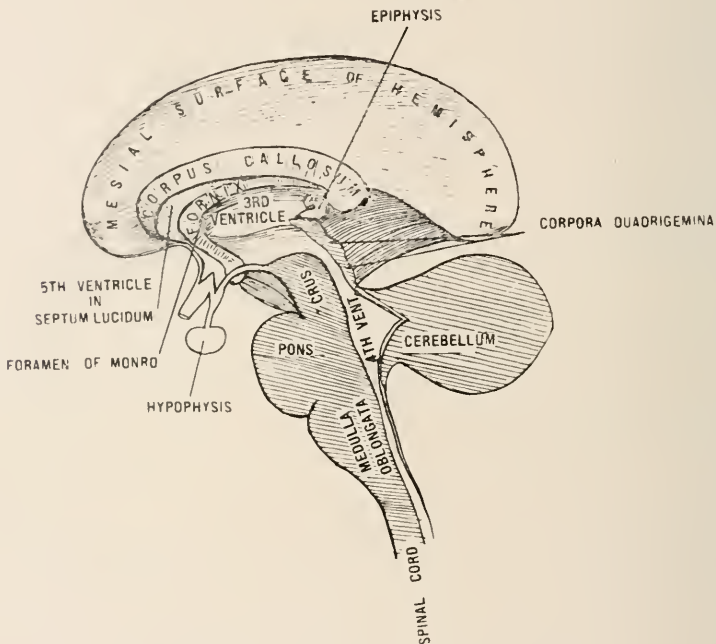
(e) Tuber annulare is the annular tuber of the brain, the pons Varolii.

The **anterior commissure** is white and situated directly in front of the anterior pillars of the fornix. (Plate CLXXX). It connects those parts of the hemispheres not connected by THE CORPUS CALLOSUM, viz., in man the temporal lobes and in osmatics the entire rhinencephalon. It forms a curve with the convexity forward and slightly upward and its extremities are spread out fan-shaped. Its center forms the anterior boundary of the third ventricle between the anterior pillars of the fornix. It passes beneath or through the head of the caudate nucleus and the posterior two-thirds of the lenticular nucleus where it is spread out in the substance of the temporal lobe. THE ANTERIOR COMMISSURE is a more primitive commissure than the corpus callosum and de-

creases in size as the corpus callosum increases. The anterior fibers of the anterior commissure (*pars olfactoria*) connect the olfactory bulbs of opposite sides and in man is very small, but in osmatics it is large, being twice as large as the posterior portion or hemispherical bundle of fibers. This **anterior portion** is large in fishes. The **posterior portion** of the anterior commissure connects the temporal lobes and the amygdalæ nucleus of opposite sides. The **middle fibers** pass through the olfactory bulb of one side to the temporal lobe of the opposite side. Thus we may have a lesion on one temporal lobe producing loss of smell of the opposite side of the nose called **CROSSED ANOSMIA**.

The **middle** or **soft commissure** is gray; it is very delicate, though sometimes it is double. It connects the two optic thalami, which takes place about

PLATE CLXVIII.



A SAGITTAL SECTION OF THE BRAIN.

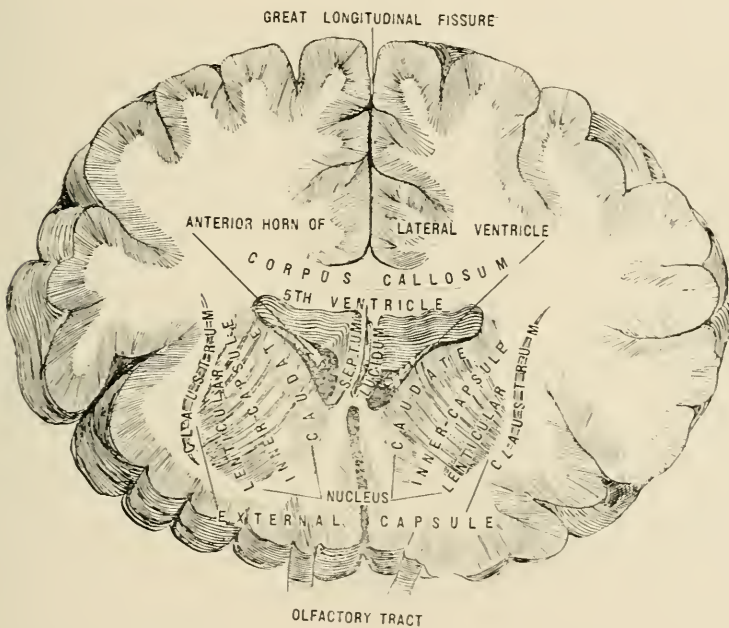
the fifth month of intra-uterine life. It is not really a commissure as no fibers pass from it from one side of the brain to the other.

The **posterior commissure** is white and is situated behind the upper end of the aqueduct of Sylvius. It forms part of the posterior boundary of the third ventricle. The pineal gland is just above and slightly posterior to it. Most of the fibers of this commissure are a continuation of the fibres of the fillet, which after decussation, pass through the optic thalamus into the corona radiata of the opposite side. The anterior fibres pass from the root of the pineal gland to the nucleus of the trigonum habenulæ on one side and the nucleus of the third nerve of the opposite side.

The **fornix** is composed of longitudinally arched bundles of fibers. It

consists of a body and two anterior pillars and two posterior pillars. It is situated just beneath the corpus callosum, its posterior part being attached to the corpus callosum. The body is triangular with the apex in front and base behind. It forms one of the boundaries of the roof of the third ventricle and part of the floor of the lateral ventricle. THE ANTERIOR PILLARS OF COLUMNÆ FORNICES, descend from the gray matter of the third ventricle behind the anterior commissure and in front of the foramen of Monro. As they descend they spread out, leaving an interval which is occupied by the septum lucidum. They receive reinforcements from the tænia semicircularis and the crura of the pineal gland and the septum lucidum. They form loops around the cor-

PLATE CLXIX.



A CORONAL SECTION THROUGH THE ANTERIOR HORNS OF THE LATERAL VENTRICLES.

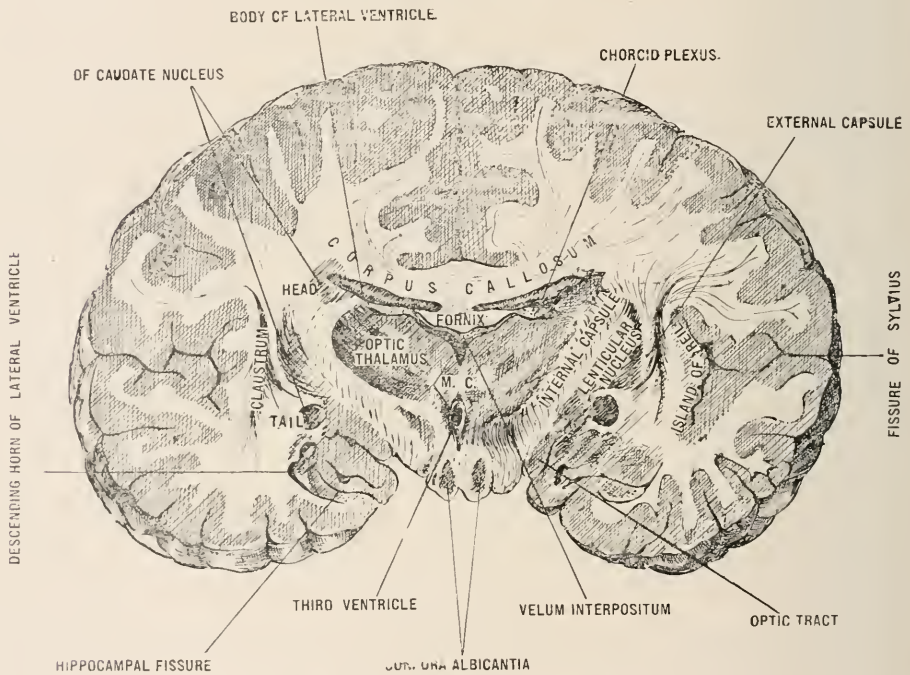
pora albicantia, making the stroma zonale or white portions of these bodies. Fibres continue from the corpora albicantia and the optic thalamus called fibers of Vizq'd'azyr. THE POSTERIOR PILLARS of the fornix descend from the sides of the body of the fornix and between the diverging crura and the splenium of the corpus callosum is the psalterium or lyra consisting of white matter and having on its surface some transverse oblique, and longitudinal lines. From its fancied resemblance to the strings of a harp this area is called a lyra. Each pillar passes around the pulvinar of the optic thalamus and then descends in the descending horn of the lateral ventricle. While there they send fibers to the hippocampus major and end in the gyrus hippocampus and the uncinate gyrus.

The corpus callosum (callous body) is the great white commissure of the

hemisphere of the brain; the commissure magna or trabs cerebri. This structure is peculiar to the mammalia; it is first found in a rudimentary state in the implacentals, and increases in size and complexity to the highest mammals, coincidentally with a degree of other special cerebral commissures. It is also called callosum.

The **corpus callosum** connects the frontal, parietal, central and occipital lobes. It is the great transverse commissure of the brain. It is three and one-half inches long on the superior surface and two and one-half inches on the inferior. It extends within one and one-fourth inches of the anterior boundary of the brain and within two inches of the posterior boundary of the brain. It

PLATE CLXX.



A CORONAL SECTION THROUGH MIDDLE COMMISSURE OF BRAIN.

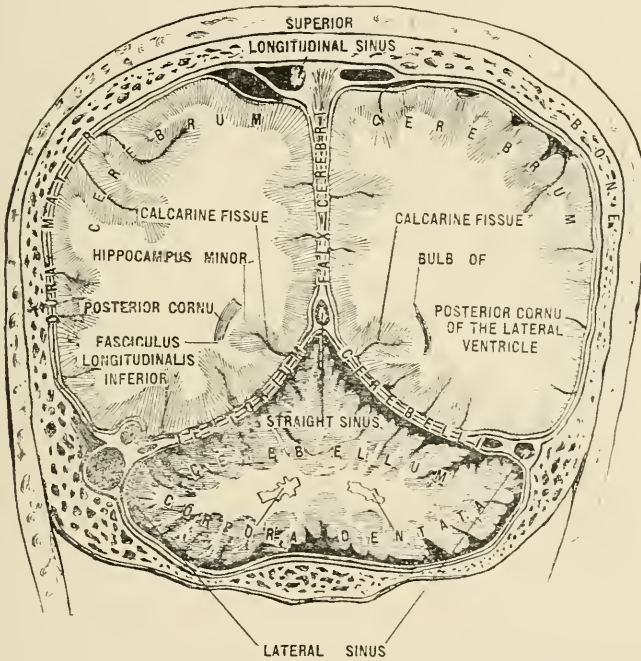
is convex above and concave below, thinner in the center of body than at either end. THE POSTERIOR END is called the splenium or ped. THE ANTERIOR END which is between the frontal lobes is called the genu or knee. The rostrum is the continuation of the genu and joins the lamina cinerea. On the superior surface a groove extends along the median line called THE RAPHE and on each side of this are THE STRIE LONGITUDINALES or NERVES OF LANCISI. These nerves are two distinct white bands given off to the termination of the corpus callosum and called the peduncles of the corpus callosum. They pass across the anterior perforated space to end in the temporal lobes, uniting with the inner root of the olfactory tract. The forceps minor are fibers which go for-

ward from the anterior and lateral angles into the frontal lobes. The forceps major are fibers which continue backward through the posterior angles into the occipital lobe.

LESSON CL.

The **septum lucidum** forms the inner boundary of the lateral ventricle and unites in front with the genu and rostrum of the corpus callosum. Posteriorly and inferiorly it is united with the fornix and its anterior peduncles. (Plate CLXXXIV). It consists of two laminae which enclose the fifth ventricle. It is

PLATE CLXXI.



A CORONAL SECTION THROUGH THE POSTERIOR HORNS OF LATERAL VENTRICLES.

a triangular area of gray matter. This ventricle was originally a part of the great longitudinal fissure but the two hemispheres are united above by the corpus callosum and below by the fornix, and the space between them becomes a distinct cavity with walls of its own—laminae or septum lucidum. The inner layer is gray, middle white, and external one ependymal or ependymal tissue covered by the epithelial layer continuous with that lining the lateral ventricle.

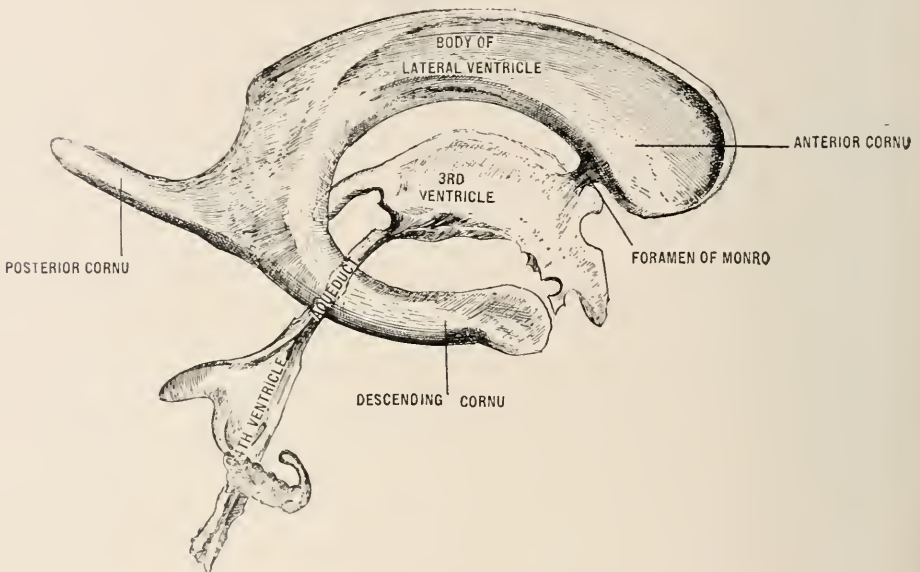
Velum interpositum or **tela choroidea superior** the word tela means a web and is applied to a membrane formed by the position of the pia mater and ependyma when the intervening layer of nerve tissue has disappeared. It is a triangular process of pia mater which is prolonged through the transverse fissure and lies over the third ventricle and upper surface of the optic thalamus. From its under surface it supplies two vascular processes which form the

choroid plexus of the third ventricle and each side the choroid plexus of the lateral ventricles are formed.

The **optic thalami** are mostly gray matter but are white externally and are situated above the tegmentum of the crus. The inner surface of each forms the lateral boundary of the third ventricle and the upper surface forms part of the floor of the lateral ventricle.

The **internal capsule** (fibres of the crusta or pes) separate the outer surface of each optic thalamus from the lenticular nucleus. Each optic thalamus has four surfaces, (1) superior or dorsal (2) inferior or ventral, (3) internal or mesial, and (4) external or lateral. The **tænia semicircularis** separates the

PLATE CLXXII.



A CAST OF THE VENTRICLES OF THE BRAIN.

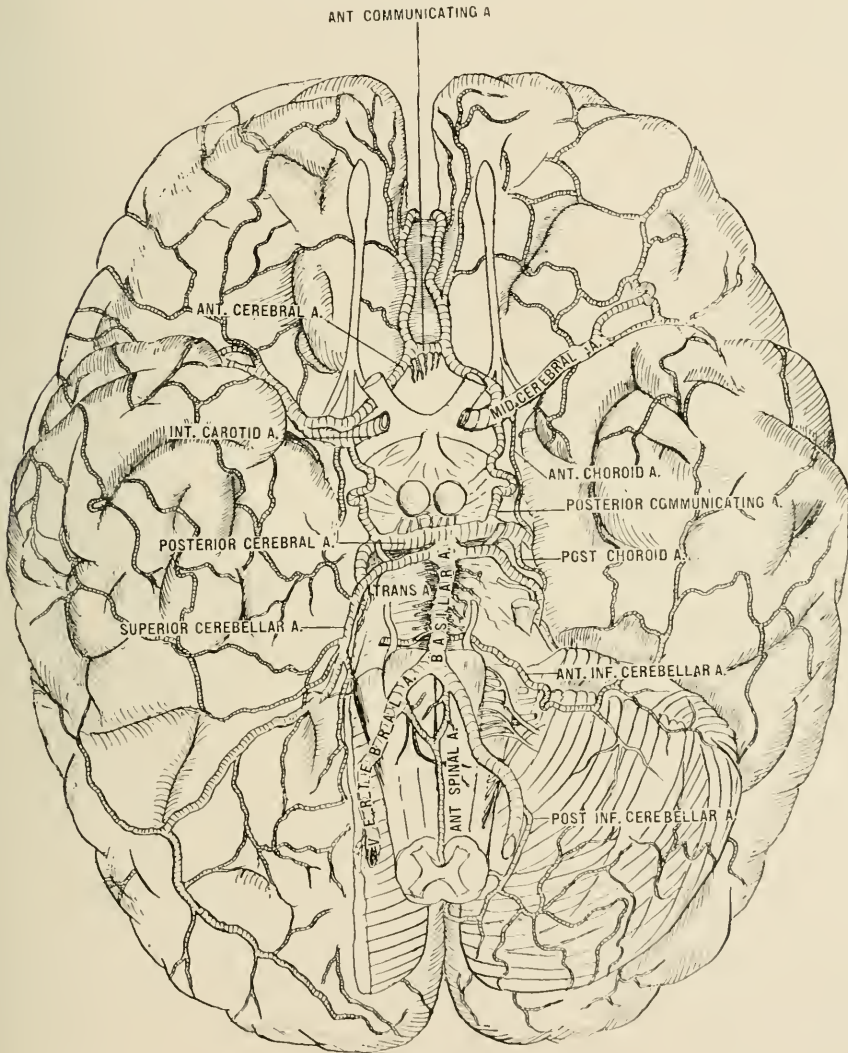
superior surface from the caudate nucleus. This surface is divided by the sulcus choroidens into mesial and lateral portions. The lateral portion of this depression is in the floor of the lateral ventricle. Anteriorly it grows into a prominence, the anterior tubercle. The superior surface is separated from the mesial surface by the peduncles of the pineal gland. The posterior surface divides into a large prominence, the **pulvinar**. The trigonum habenulæ is a depressed area of gray matter between the pulvinar and the beginning of the peduncles of the pineal gland. The ganglia of habenulæ is anterior to the trigonum habenulæ.

The **internal** and **external geniculate bodies** are elevations of gray matter on the posterior and inferior surface of the pulvinar. The internal geniculate body is situated on the inferior and inner side of the pulvinar, between the brachia of the corpora quadrigemina. It is covered with a layer of white fibers. The external geniculate body is below and external to the internal geniculate.

It is of a yellowish-gray color. The projection system of fibers which pass through the internal capsule and bundles are the peduncles of the optic thalamus.

The **pineal gland**, also called **conarium** and **epiphysis**, is a small reddish body

PLATE CLXXIII.



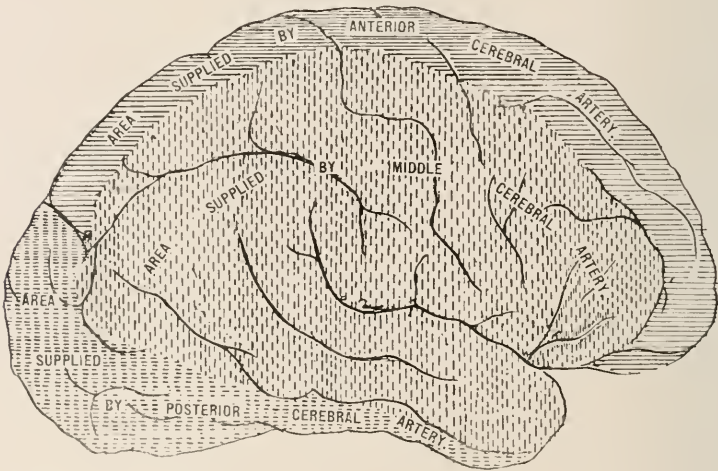
CIRCLE OF WILLIS AND ARTERIES OF BRAIN.

THE CIRCLE OF WILLIS.

developed from the hinder part of the roof of the first cerebral vesicle, and lying in front of and above the pons. Its substance consists mainly of epithelial follicles and connective tissue; there is no evidence that it is a nervous structure, and its function, if it possesses any, is unknown. It was formerly supposed by some (as the Cartesians) to be the seat of the soul. (Plate CLXXX).

There are **numerous peduncles of the brain**. Those of the cerebellum are three pairs and are stout bundles of nerve fibres which connect the cerebellum with other chief divisions of the brain. They are distinguished by their position as superior, middle, and inferior peduncles or crura. The **superior pair** emerge from the mesial part of the medullary substance of the hemispheres, and run forward upward to reach the nuclei tegmenti of the opposite sides, after decussation under the formatio reticularis. Also called (1) crura ad corpora quadrigemina, (2) crura ad cerebrum, (3) processus cerebelli ad cerebrum, (4) processus-e-cerebello ad testes, (5) branchia conjunctiva, and (6) branchia conjunctoria). (Plate CLXXXVIII).

PLATE CLXXIV.



SHOWING BLOOD SUPPLY OF THE EXTERNAL SURFACE OF THE BRAIN.

The **middle pair** from the ventral transverse fibres of the pons, emerging from the lateral part of the white substance of the hemispheres. (Also called crura or processus ad medullam). (Plate CLXXXVIII).

LESSON CII.

The **fissures** of the cerebellum are three in number—two vertical and one horizontal. The **great horizontal fissure** is a continuous fissure which separates the cerebellum into upper and lower portions. It begins in front at the middle peduncles, and extends around the outer and posterior border of each hemisphere.

THE VERTICAL ONES ARE:

1. **Incisura cerebelli anterior**, the anterior median notch of the cerebellum, into which the corpora quadrigemina are received.

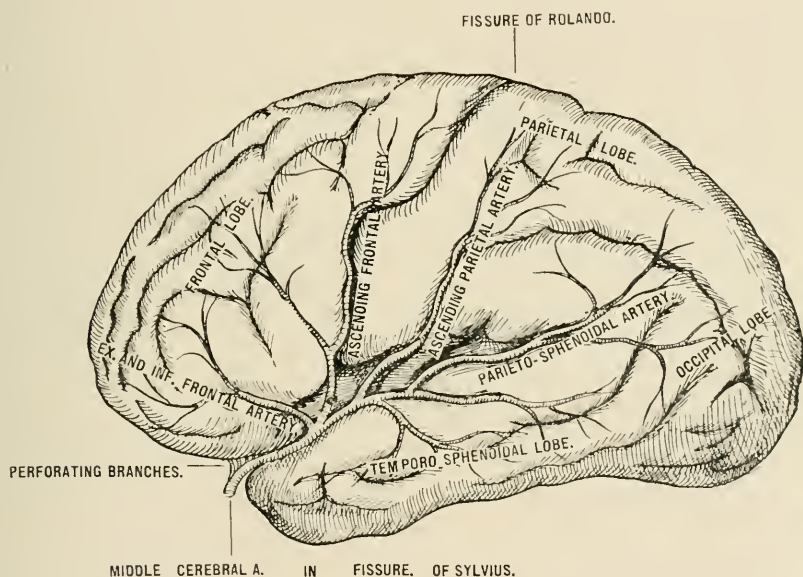
2. **Incisura cerebelli posterior**, the median notch on the posterior outline of the cerebellum, formed by the projection of the cerebellar hemispheres beyond the vermis. (Plate CLXXXVIII).

The **vermis** is the median lobe of the cerebellum; the vermiform process of the cerebellum is divided into THE PREVERMIS and THE POSTVERMIS.

The olivary body is the ganglion of the oblongata lying on either side just lateral of the pyramid, and forming an oval projection on the surface just below the pons. It consists of the nucleus olivaris inferior with a covering and filling of white matter, also called inferior olivary body, or inferior olive, and corpus semiovale.

The corpus dentatum is (a) a plicated capsule of gray matter, open anteriorly, situated within the white substance of each cerebellar hemisphere. Also called ganglion of the cerebellum and nucleus dentatus. (b) A somewhat similar mass of gray matter in each olivary body. Also called corpus ciliare.

PLATE CLXXV.



SHOWING DISTRIBUTION OF MIDDLE CEREBRAL ARTERY.

The lateral tract is continuous with the lateral column of the spinal cord, lies behind the olivary body and in front of the restiform.

The restiform body is the inferior peduncle of the cerebellum, by which it connects with the oblongata and parts below. It contains the direct cerebellar-tract fibres, crossed and uncrossed from the posterior columns of the cord, and fibres from the centra-lateral (lower) olive.

The fillet is some special bundle of nerve-fibres; especially, a band of longitudinal fibres lying in the ventral and outer parts of the tegmental region of the brain. Its distribution is not known, but it seems to connect below with the posterior columns of the spinal cord and above with the corpora quadrigemina, optic thalami, lenticular nucleus, and cortex cerebri. It is also called lemniscus.

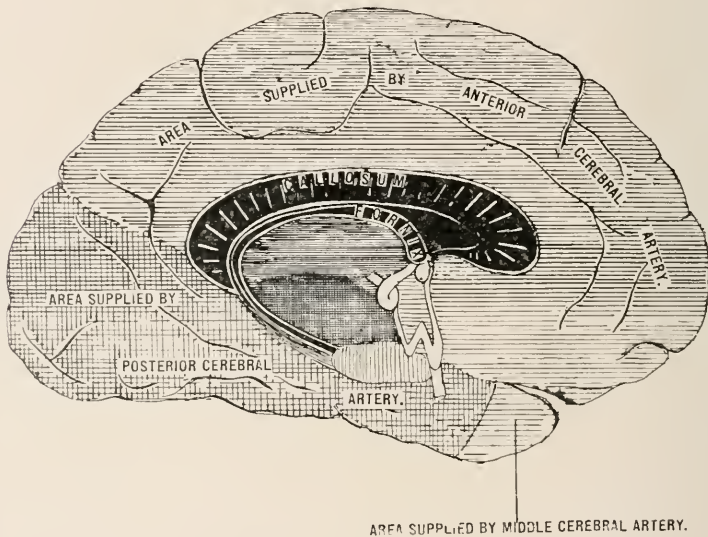
A vesicle is a small, bladder-like structure, cavity cell, or the like, in a body. There are three vesicles in the brain, anterior, middle, and posterior. They are

embryonic and so transitory, and have other names when matured. They are called anterior, middle, and posterior, corresponding to the fore-brain, mid-brain, and hind-brain. They are primitive structures and become the ventricles of the brain. The three commonly form five by the subdivision of two of them.

The **septum lucidum** is the median partition of the lateral ventricles of the brain, inclosing the camera, pseudocoele, or so-called fifth ventricle. Also called (1) septum pellucidum, (2) septum medium, (3) septum ventriculorum, (4) ventricular septum, (5) septum medullare triangulare.

The **fornix** is an arch. In the human brain it consists of two longitudinal bundles of fibres, one on each side, which rise from the corpora albicantia, pass up, as THE ANTERIOR PILLARS of the fornix in front of the foramina of Monro

PLATE CLXXVI.



SHOWING BLOOD SUPPLY ON MESIAL SURFACE, (SAGITTAL SECTION OF BRAIN).

and behind the anterior commissure, these somewhat flattened and in apposition to each other, arch backward beneath the corpus callosum and above the velum interpositum, forming the body of the fornix and then diverge toward the back part of the corpus callosum, to turn down, as THE POSTERIOR PILLARS of the fornix (crura fornicee), into the floor of the descending cornua of the lateral ventricles, where their free edges form the fimbriae.

The **fimbria** is a narrow band of white fibres running along the median concave side of the hippocampus major. It is a continuation of the pillars of the fornix. Also called tænia hippocampa and corpus fimbriatum.

The **tænia semilunaris** consists of commissural fibres between the corpus striatum and the optic thalamus.

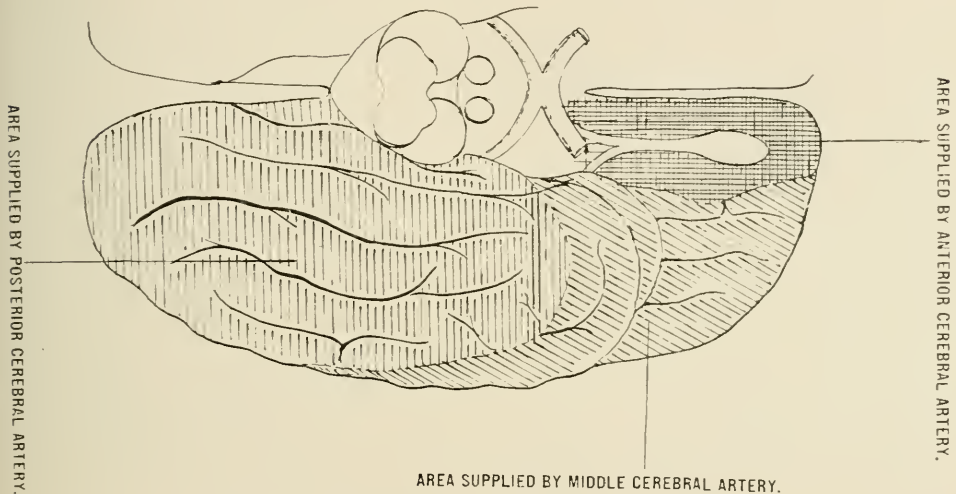
The **cerebrum** is that portion of the brain which lies in front of the cerebellum and pons Varolii. It comprises about seven-eighths of the weight of the brain. It is the center of intelligence and thought.

The **cerebellum** is called the arbor-vitæ or tree of life. It is the center for the control of muscles. It is between the corpora quadrigemina in front and the medulla oblongata behind, and forming part of the roof of the fourth ventricle.

The **pons**, also called **pons Varolii** and **pons cerebelli**, is a great transverse commissure seen at the base of the brain in front of the medulla. Its fibres connect the hemispheres of the cerebellum with each other and the medulla.

The **medulla oblongata** is (a) marrow; (b) the so-called spinal nervous system; the myelon; more fully called medulla spinalis; (c) the hindmost segment of the brain, continuous with the spinal cord.

PLATE CLXXVII.



SHOWING BLOOD SUPPLY AT BASE OF BRAIN.

A **ventricle** (literally a belly, a stomach) is a small cavity. Those of the brain are a series of connecting cavities, containing fluids, within the brain, continuous with the central cavity of the spinal cord. They are the remains of the original neural canal, formed by a folding over of the epiblast.

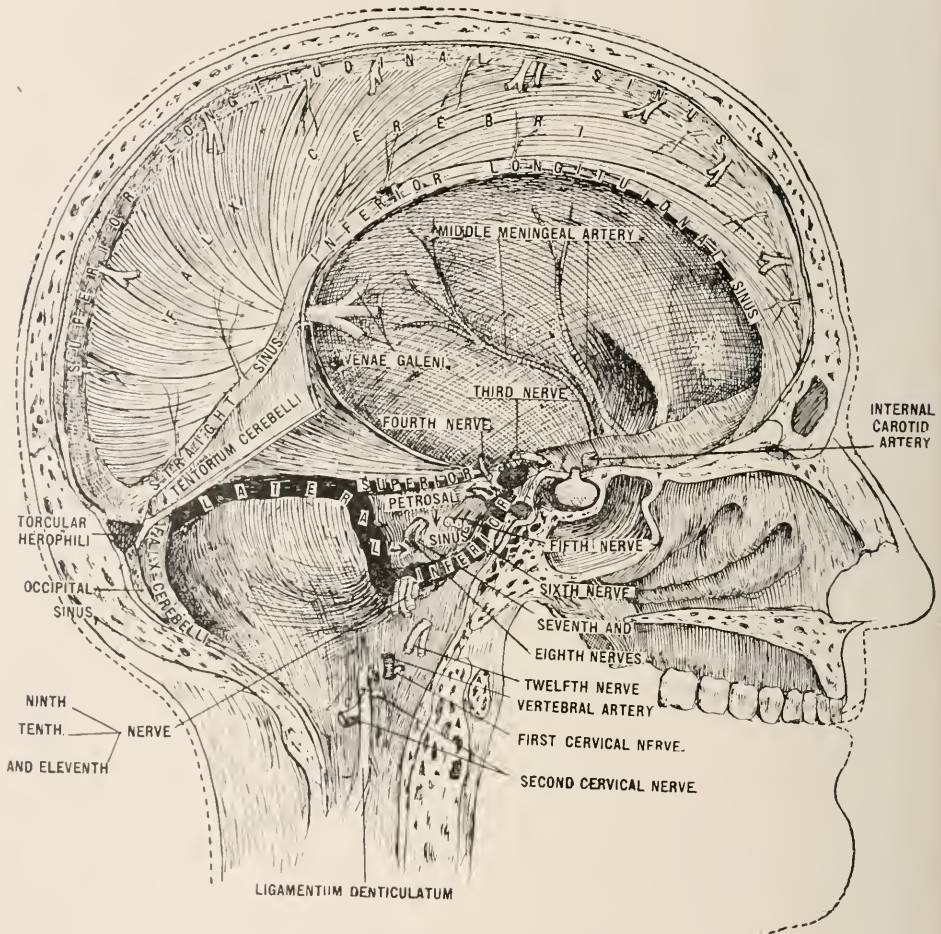
The **optic commissure** or **chiasma**, somewhat quadrilateral in form, rests upon the optic groove of the sphenoid bone, being bounded, above, by the lamina cinerea; behind, by the tuber cinereum; on either side, by the anterior perforated space. Within the commissure the optic nerves of the two sides undergo a partial decussation. The fibres which form the inner margin (inferior commissure of Gudden) of each tract are continuous across from one to the other side of the brain. These may be regarded as commissural fibres (intercerebral) between the internal geniculate bodies. Some fibres are continued across the anterior border of the chiasma, and connect the optic nerves of the two sides, having no relation with the optic tracts. They may be regarded as commissural fibres between the two retinæ (inter-retinal fibres). The outer fibres of each tract are continued into the optic nerve of the same side.

The central fibres of each tract are continued into the optic nerve of the opposite side, decussating in the commissure with similar fibres of the opposite tract.

The **ventricles** are TWO LATERAL, THIRD VENTRICLE, FOURTH VENTRICLE, FIFTH VENTRICLE, and THE VENTRICLE OF THE CORPUS CALLOSUM.

The **lateral ventricles** are found one in each hemisphere; they communicate with each other and with the third ventricle through the foramen of Monro.

PLATE CLXXVIII.



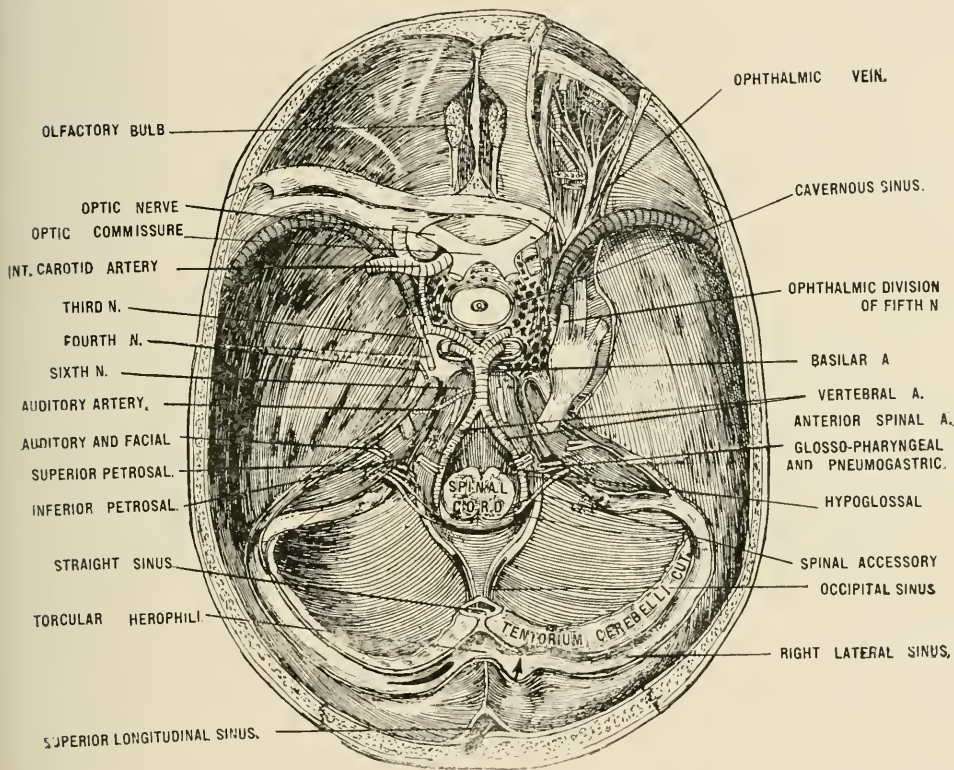
SHOWING FALX CEREBRI, ETC.

The **third ventricle** lies between the optic thalami. It communicates with the fourth ventricle through the aqueduct of Sylvius. The **fourth ventricle** lies between the cerebellum and the pons and medulla. The so-called **fifth ventricle**, or **pseudocoel**, has no connection with the other cerebral ventricles, being of a different nature and simply a small interval between the right and left layers of the septum lucidum.

LESSON CIII.

The **Medulla Oblongata** is about one and one-half inches long and three-fourths of an inch wide and one-half of an inch antero-posteriorly. It extends from the foramen magnum inferiorly to the pons superiorly. It is the smallest part of the main divisions of the brain but the largest from a physiological standpoint. It has five main centers in it, viz., (1) Respiratory, (2) Cardio-inhibitory, (3) Vasomotor, (4) Diabetic, and (5) Salivary. (Plate CLXXXVII).

PLATE CLXXIX.

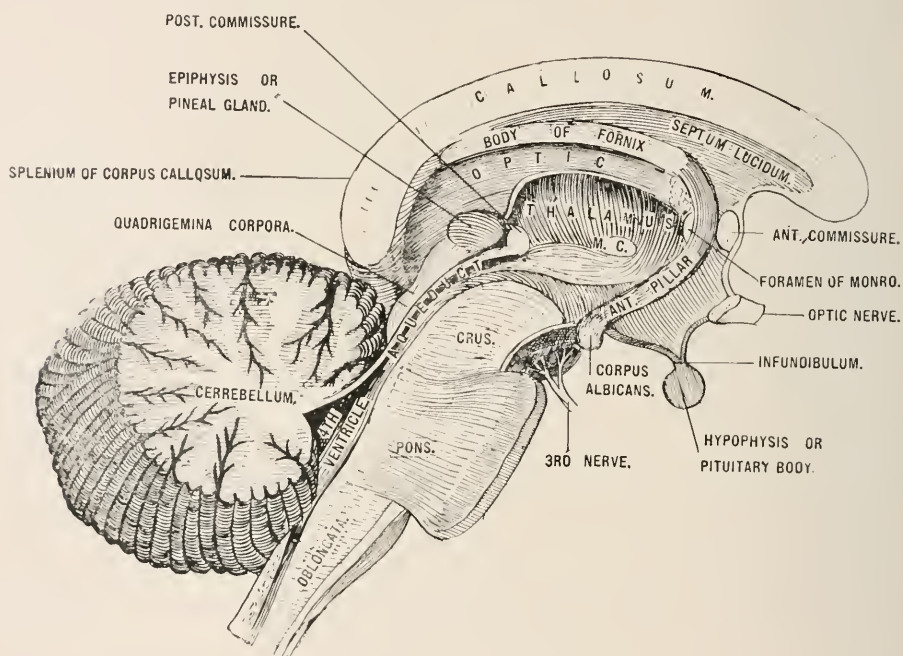


SINUSES AT THE BASE OF THE BRAIN.

It is **gray** on the outer side and **white** on the inner. ITS POSTERIOR SURFACE makes the lower part of the anterior boundary or the floor of the fourth ventricle. ITS ANTERIOR SURFACE rests upon the basilar process of the occipital bone. In the median line of the anterior surface is the antero-median fissure which is continuous with the antero-median fissure of the cord. On each side of this fissure there is a pyramid. This pyramid has fibres next to the fissure which are derived from the crossed pyramidal tracts after they push the gray matter of the anterior horn of the cord superficially. Next to this it has the fibres of the direct pyramidal tract. External to the pyramid we have the olivary body superiorly and the lateral tract inferiorly. This olivary body has

the inferior olivary nucleus and the dentates nucleus. The olivary nucleus is hollow and gives off, from an opening in its side, little fibres called the peduncles of the olivary body. Next to the olivary and lateral tract external we have part of the restiform body. Another name for the **restiform body** is **inferior pedicles of the cerebellum**. The posterior surface of the medulla has the postero-median fissure and on each side of it is (1) the funiculus gracilis, (2) funiculus cuneatus, (3) the funiculus Rolando, (4) lateral tract. The upper portion of the posterior surface makes the **restiform body** or the **inferior peduncles of the cerebellum**.

PLATE CLXXX.



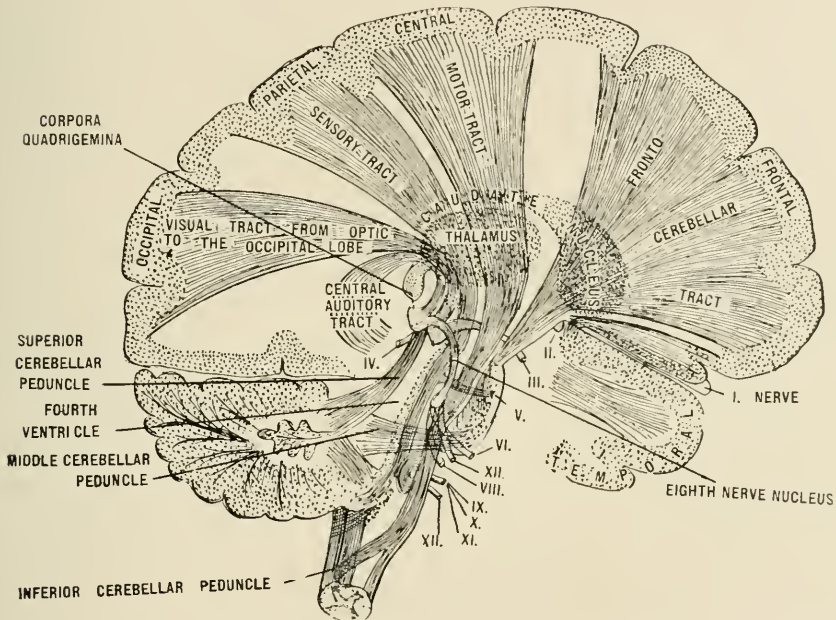
A SAGITTAL SECTION OF BRAIN, SHOWING THE THIRD AND FOURTH VENTRICLES

The fibres in the cord which travel through the direct cerebellar tract, which is in the lateral column of the cord, pass up into the medulla into the restiform body, instead of passing straight into the lateral column. The funiculus Rolando is a continuation of the gray matter from the posterior horn of the cord, where it is called substantia gelatinosa Rolando, up into the medulla where it is situated between the funiculus cuneatus and lateral column.

Cerebellum (little brain) is about one-tenth of the entire brain. It weighs about five ounces. It is about one-eighth as large as the cerebrum in the adult. In early childhood it may be as small as one-twentieth of the cerebrum. It is situated in the posterior fossa at the base of the skull, being separated from the cerebrum by the tentorium cerebelli. It consists of two hemispheres connected by the worm (vermiform process). The medulla is situated in the anterior

inferior portion in a groove called the **vallecula**. The falx cerebelli is situated in a groove posterior to the worm between the two hemispheres. The hemispheres have fissures like the cerebrum but do not have convolutions like the cerebrum but instead have folia. The cerebellum is gray on the outer side and white on the inner side. It forms the roof or posterior boundary of the fourth ventricle.

PLATE CLXXXI.



A SAGITTAL SECTION OF BRAIN SHOWING FIBERS.

THE WORM, COMMENCING WITH THE ANTERIOR SUPERIOR PART, AND PASSING BACKWARD CONSISTS OF THE FOLLOWING PARTS:

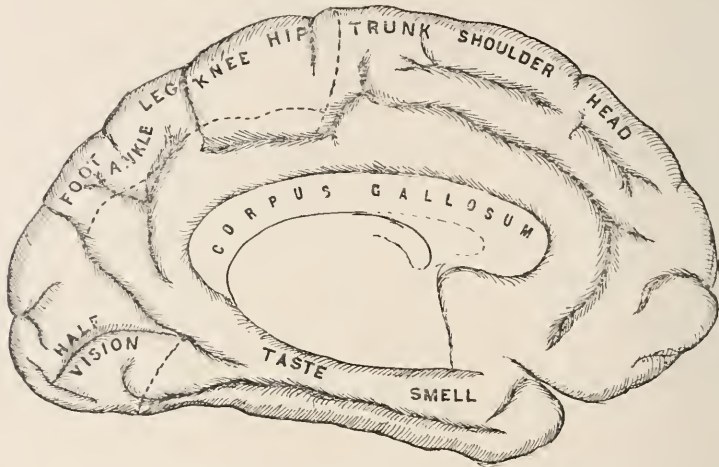
Frænulum	(1) Lingulæ	Frænulum
	Precentral fissure	
Ala lobulus centralis	(2) Lobulus centralis	Ala lobulus centralis
	Post-central fissure	
Anterior crescentic-lobule	(3) Culmen monticuli	Anterior crescentic lobule
	Preclival fissure	
Posterior crescentic lobule	(4) Clivus	Posterior crescentic lobule.
	Post-clival fissure	
Posterior superior lobule	(5) Folium cacuminis	Posterior superior lobule

THE LOWER WORM FROM BEFORE BACKWARD CONSISTS OF THE FOLLOWING PARTS:

Flocculus	(1) Nodule	Flocculus
Amygdala	(2) Uvula	Amygdala
Biventral	(3) Pyramid	Biventral
Sledner lobe		Slender lobe
Post-gracile fissure	(4) Tuber valvulæ	Post-gracile fissure
Postero-inferior lobe		Postero-inferior lobe
(Inferior semilunar)		(Inferior semilunar)

There are four sets of gray nuclei in the white matter of each hemisphere called (1) Corpus dentatum. (2) Nucleus emboliformis. (3) Nucleus globosis. (4) Nucleus fastigii. (Plate CLXXI).

PLATE CLXXXII.



A SAGITTAL SECTION OF BRAIN, SHOWING CENTERS OF SMELL AND TASTE.

The **cerebellum** has three sets of peduncles, THE SUPERIOR ONES pass from the cerebellum to the corpora quadrigemina (processes-c-cerebelli ad testes) and have efferent fibres in them.* THE MIDDLE ONES connect the middle part of the cerebellum with the pons and have both afferent and efferent fibres. THE INFERIOR ONES connect the cerebrum with the cord and are called the restiform bodies.

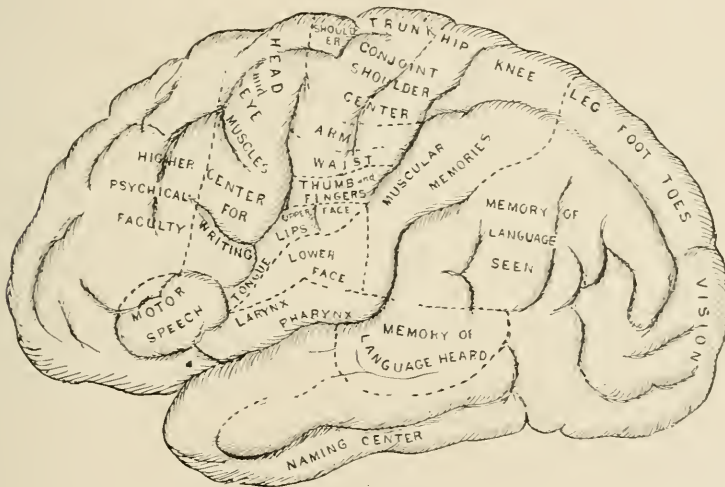
LESSON CIV.

The **pons** is the connecting link for the other parts of the brain. It is connected to the cerebellum by the middle peduncles of the cerebellum. It is connected to the cerebrum by the crus cerebri or the peduncles of the cerebrum. It is connected to the medulla by fibres through the pyramidal tract. It is situated on the basilar process of the occipital bone and the posterior part of the sphenoid bone. It is one inch long and one and one-half inches wide. Its

*There are afferent fibres immediately beneath the superior peduncle in the valve of Vieussens.

anterior surface is convex from side to side and slightly convex from above downward. Its superior border is longer than the lower border and is convex, while the lower border is almost straight. In the median line on the anterior surface there is a groove for the basilar artery. Its posterior surface is concave and forms the upper part of the floor of the fourth ventricle. A coronal section will divide it into an anterior or inferior portion and a posterior or superior portion. The posterior part is called **tegmentum**. The **anterior part** consists of three main divisions (1) superficial transverse fibres which pass from the middle peduncles of the cerebrum and give the pons its name., (2) deep transverse fibres which decussate in the pons connecting one side of the cerebellum with the opposite side of the cerebrum. (3) is longitudinal fibres which intermingle with the deep transverse fibres and pass through the medulla into

PLATE CLXXXIII.



LOCATION OF CENTERS OF THE BRAIN.

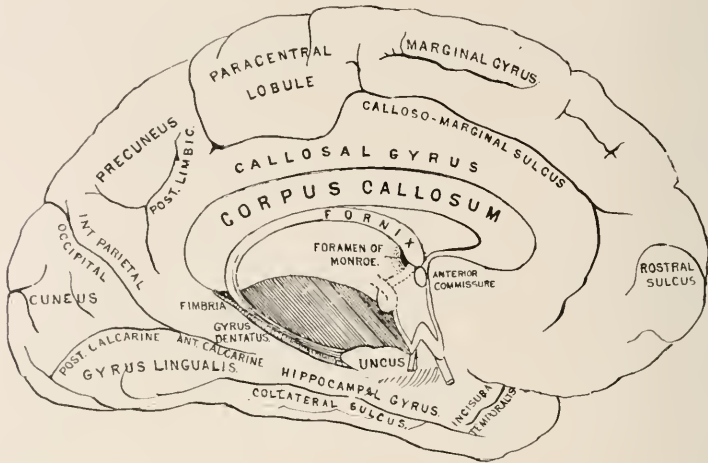
the crusta or pes of the crus. The **tegmental portion of the pons**, or **posterior part**, has four main parts. Anteriorly (1) the fillet, (2) formatio reticularis, (3) posterior longitudinal bundles, and (4) superior olivary nucleus.

A **hemorrhage** in the pons, if it is above the decussation of the seventh nerve will cause paralysis of the opposite side of the face and opposite side of the body but if it is below the decussation of the seventh nerve it will cause paralysis of the same side of the face and opposite side of the body, producing what is known as crossed hemisphlegia. The sixth nerve, seventh nerve, and part of the eighth nerve have their deep origin in this part of the pons. The **crus cerebri** or the **peduncles of the cerebrum** pass upward and outward from the upper margin of the pons into the substance of the cerebrum. They are about three-fourths of an inch long. A coronal section will divide this into an anterior or inferior and a posterior or **tegmental portion**. The anterior is called **crusta**

or **pes** and has motor fibres in it. The posterior portion is the tegmental portion and has sensory fibres in it.

The **Restiform body** or **inferior peduncles of the cerebellum** receives its fibres from four main sources (1) from the nucleus gracilis et cuneatus of the same side, (2) from nucleus gracilis et cuneatus of opposite side, (3) from the lateral column of the cord through the direct cerebellar tract, (4) from the nucleus of the olivary body of the opposite side.

PLATE CLXXXIV.



A SAGITTAL SECTION OF THE BRAIN.

The area where the cranial nerves leave the brain substance is called the **SUPERFICIAL ORIGIN**. The **group of cells** from which the fibers spring or in which they end is the **DEEP ORIGIN**. (Plate CLXXXVII).

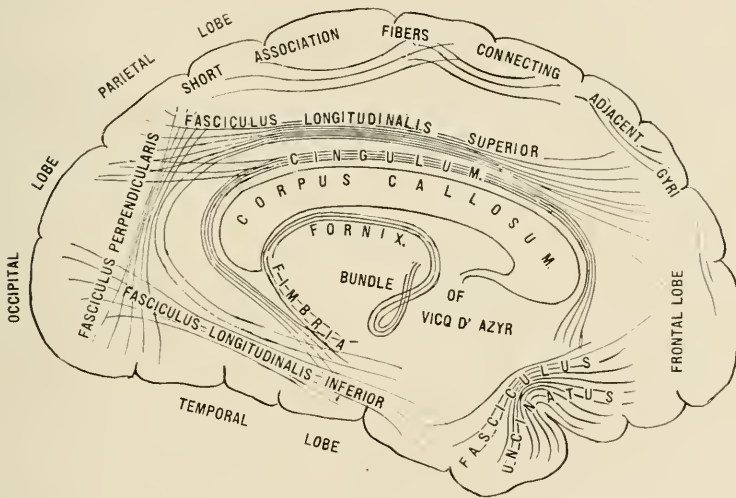
Rule.—The **DEEP ORIGIN** of all the cranial nerves, except the **first** and **second** and a **part of the eleventh**, is in the floor of the **AQUEDUCT OF SYLVIVS** or in the floor of the **FOURTH VENTRICLE**. The third and fourth have their deep origin in the aqueduct of Sylvius. The fifth, sixth, seventh, eighth, ninth, tenth, part of the eleventh, and twelfth have their deep origin in the floor of the fourth ventricle.

Definition for centre.—(1) Any **GANGLION** or **PLEXUS** giving off nerves which control function. (2) Any **GROUP OF GANGLION CELLS** which has a stimulating or inhibitory office. (3) It is a **GROUP OF GANGLION CELLS** closely connected with one another and acting together in the performance of some function, as the cerebral centers, psychical centers; respiratory or vaso-motor centers.

The **first** and **second** cranial nerves are processes of the brain and therefore have neither superficial nor deep origin. We say there are **twelve pairs** of cranial nerves; it would be better to say **twelve sets** for in the first or olfactory nerves there are twenty or thirty nerves. The **first** nerve is one of special sense, that of smell. The **primary center** for smell is in the olfactory lobe. (Plate

CXCIX) the **secondary center** in the uncinate gyrus of the temporal lobe on the mesial surface. (Plate CLXXXII). This has been demonstrated by experiments upon animals and by pathological research on the brain of man. In **osmatic animals** these lobes (gyrus hippocampus, uncinate, and hippocampus major) where the center of smell is located, are well defined. In **anosmatic** they are small. **If the olfactory tract be removed** these lobes will atrophy and in case of lesion in these lobes the loss of smell (anosmia) will follow. The **olfactory tracts**, which are white, lie almost parallel to one another, extending from the under surface of the frontal lobe. The **bulb** is reddish-gray in color and lies on the cribriform plate of the ethmoid. From the bottom of these bulbs the olfactory nerves are given off, twenty or thirty in number, to be distributed to the **CELLS OF SCHULTZE** in the **SCHNEIDERIAN MEMBRANE**. The **three roots** from the tracts are the external, middle, and internal. The **EXTERNAL ROOT**

PLATE CLXXXV.



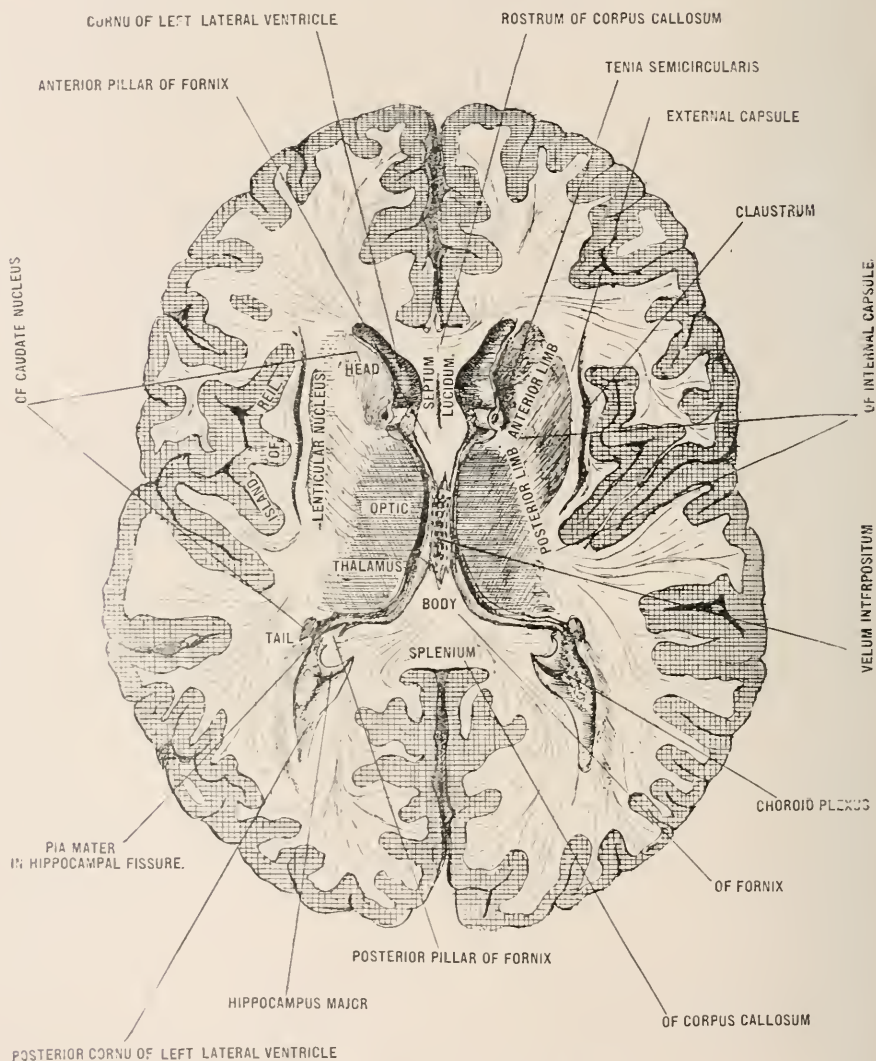
SHOWING LONG AND SHORT ASSOCIATION FIBERS OF THE BRAIN.

is white and extends into the anterior end of the hippocampus gyrus of the temporo-sphenoidal lobe. The **MIDDLE ONE** is gray and ends in the trigonum olfactorium. The **INNER ONE**, or **MESIAL ROOT**, is white and passes backward and inward to end in the anterior extremity of the gyrus fornicatus. The **MESIAL ROOT** is continuous with one end of the limbic lobe and the external root with the other. This nerve is made up exclusively of non-medullated fibers. They are deficient in the white substance of Schwann and consist of axis-cylinders with a distant nucleated sheath in which there are, however, fewer nuclei than in the ordinary non-medullated fibers.

1. **Anosmia** is the loss of smell.
2. **Hyperosmia** is increased sensitiveness.
3. **Parosmia** is perversion of the function of smell.
4. **Kakosmia** is a condition where everything smells alike to the patient and the odor is a peculiar or offensive one.

The **arachnoid** holds the tracts in position in the sulci. The **dura mater** covers the nerves and is continuous with the periosteum of the nasal fossa. The **pia mater** is continuous with the neurilemma.

PLATE CLXXXVI.

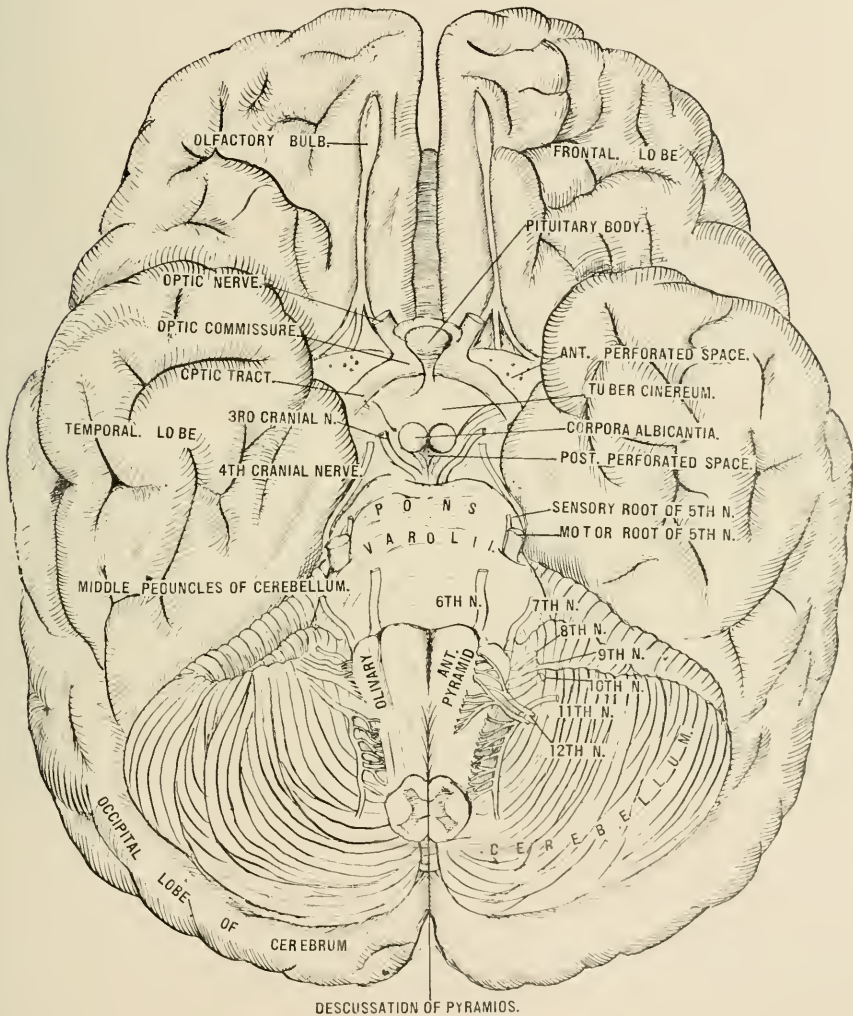


A HORIZONTAL SECTION OF THE BRAIN.

The **second cranial nerve** or **optic nerve** is a process of the brain like the olfactory. The center for sight is in the cuneate lobule of the occipital lobe. The **optic nerve** extends forward and outward from the **OPTIC COMMISSURE** or **CHIASMA** to the posterior part of the eye-ball, entering a little to the inner side of the center to spread out into the retina. The **CHIASMA** or **COMMISSURE** is rectangular and rests upon the olivary eminence of the sphenoid bone and on the anterior part

of the diaphragma sellae. Above it is the lamina cinerea, behind it is the tuber cinereum. On either side is the anterior perforated space. The **optic tracts** extend outward and backward from the chiasma to (1) the external geniculate body. (2) The posterior or inferior quadrigeminal body. (3) The

PLATE CLXXXVII.

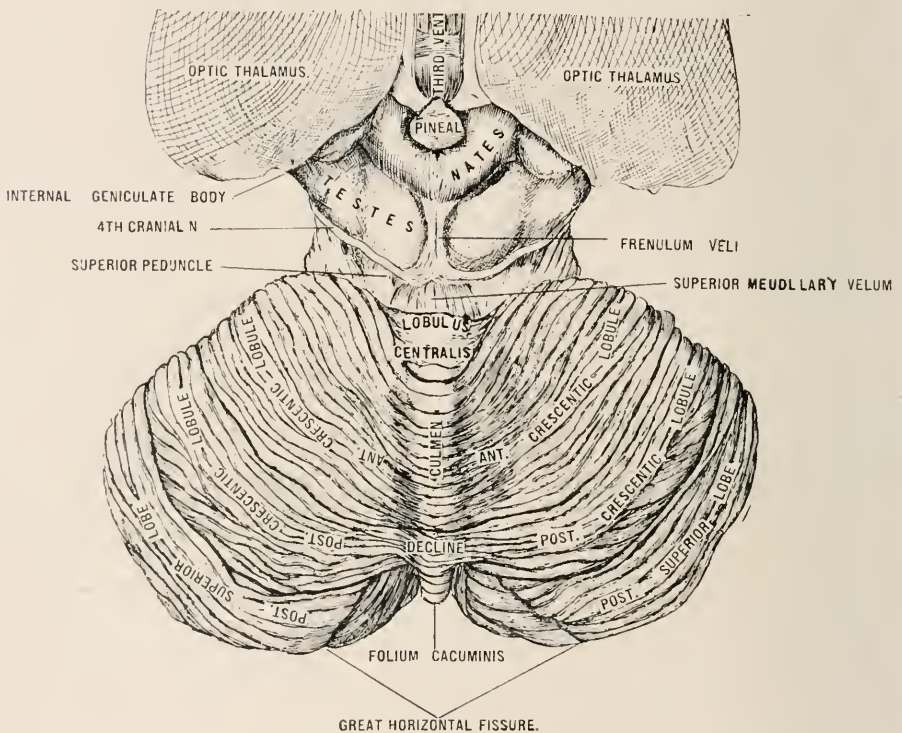


SHOWING SUPERFICIAL ORIGIN OF THE CRANIAL NERVES.

internal geniculate body. (4) Under part of the pulvina of the optic thalamus. From these four parts the **optic radiations** extend to the center of sight. Those fibers which do not decussate at the OPTIC COMMISSURE have already decussated in the CORPORA QUADRIGEMINA. This is the reason that a lesion of one center of sight will cause blindness in the opposite eye and vice versa, for both sets of decussating fibers are destroyed. A **lesion** through the middle of

the chiasma will produce blindness in the INNER HALF OF EACH EYE. A **lesion** of the left optic nerve will produce blindness in the LEFT EYE and VICE VERSA. A **lesion** of the left optic tract will produce blindness in the LEFT HALF of each eye and VICE VERSA. As this nerve passes from the brain it receives coverings from the **dura mater, arachnoid, and pia mater**. It passes through the optic foramen with the ophthalmic artery, being above and on the inner side of the artery. The **OPTIC, MOTOR OCULI, TROCHLEAR, TRIFACIAL, and the ABDUCENT NERVES** are all concerned with the eye-ball and its apparatus, thus making all the of

PLATE CLXXXVIII.



THE SUPERIOR VIEW OF THE CEREBELLUM.

first six cranial nerves, excepting the **first**. The **optic nerve** is the nerve of sight. The **motor oculi, trochlear, and abducent** are the nerves to the muscles of the eyeball, and the **fifth nerve** supplies the ophthalmic, lenticular, or ciliary ganglion with one of its roots, from which ganglion nerves pass to the iris.

The **eyeball** is located in the orbit which consists of seven bones, viz., (1) frontal, (2) ethmoid, (3) sphenoid, (4) lachrymal, (5) superior maxillary, (6) malar, and (7) palate. In the two orbits there are but eleven bones, the **frontal, ethmoid and sphenoid** being common to the two. The **ORBIT** is somewhat pyramidal in shape with the base forward and apex backward. (Plate CCXXIX) The axial lines, if extended, would meet on the sella turcica of the sphenoid.

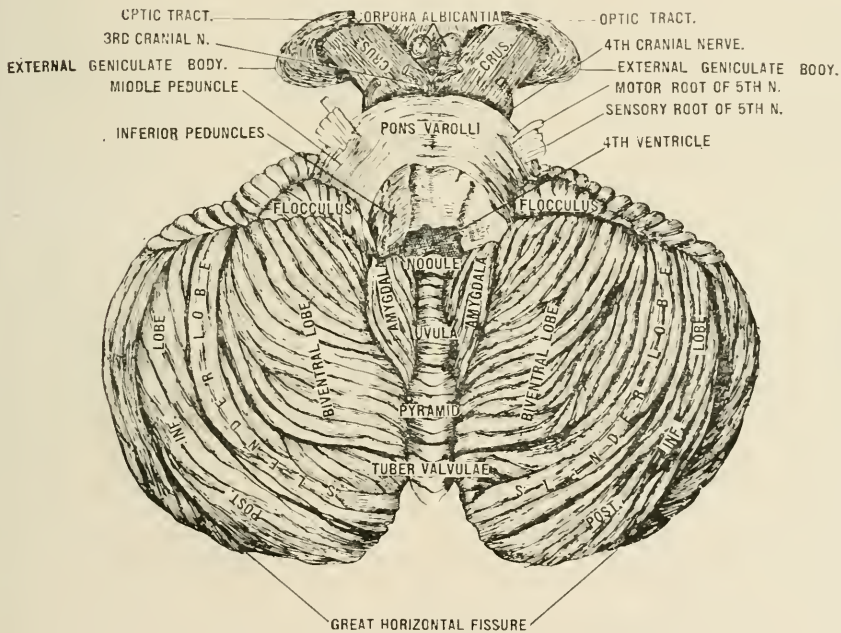
The orbit communicates with the cavity of the cranium by (1) the optic foramen and (2) the sphenoidal fissure. It communicates with four fossæ, (1) with the nasal fossa by the nasal duct, (2) with the temporal fossa, (3) with the zygomatic fossa, (4) and with the sphe-no-maxillary fossa. These last three by the sphe-no-maxillary fissure.

Each orbit has nine foramina.—(1) supraorbital, (2) infraorbital, (3) anterior ethmoidal, (4) posterior ethmoidal, (5) optic, (6) sphenoidal fissure, (7) sphe-no-maxillary fissure, (8) nasal duct, (9) malar foramina.

LESSON CV.

The **floor** is formed by three bones, (1) the orbital surface of the superior maxillary; (2) the orbital process of the malar; (3) the orbital process of the

PLATE CLXXXIX.



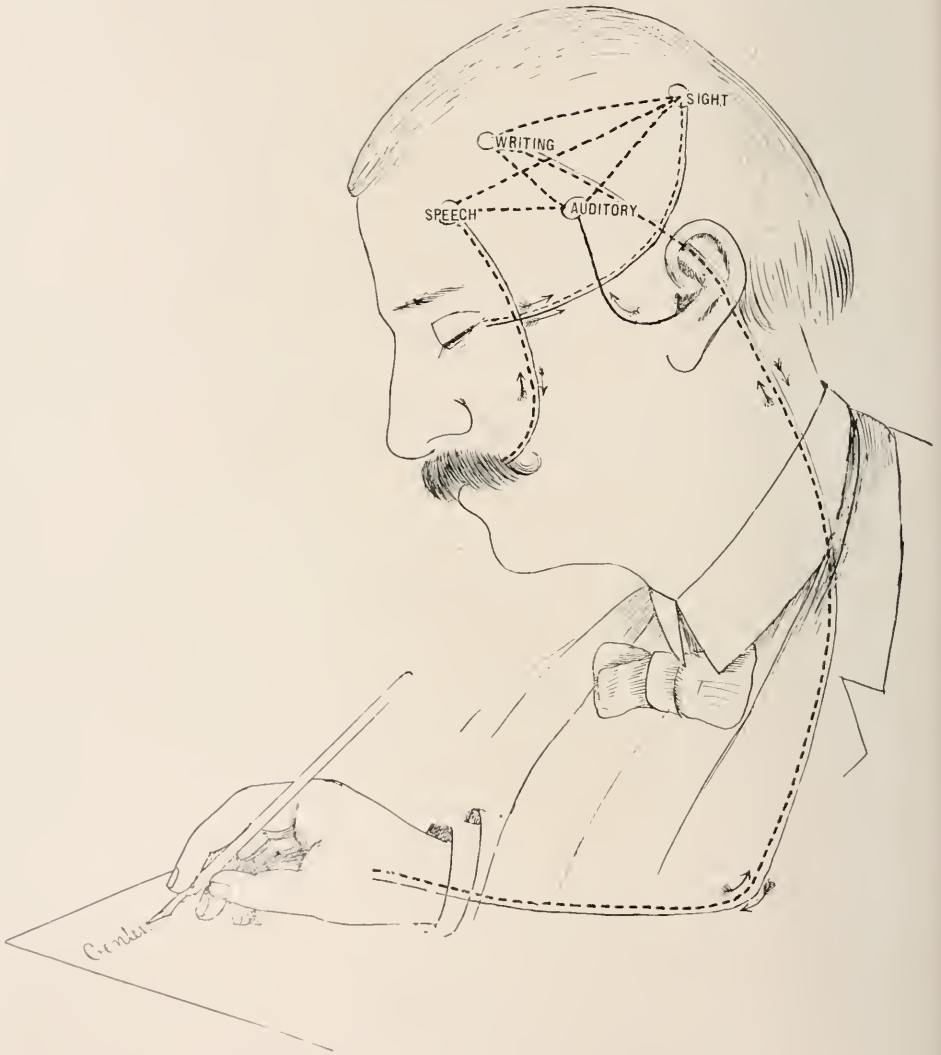
THE INFERIOR VIEW OF THE CEREBELLUM.

palate. The **FLOOR** is somewhat flat and has (1) the infraorbital canal; (2) a depression for the Inferior oblique muscle anteriorly; (3) the infraorbital groove posteriorly; (4) the palato-maxillary suture posteriorly. The **roof** is formed by the two bones, (1) the orbital plate of the frontal bone anteriorly; (2) the lesser wing of the sphenoid posteriorly. The roof is dome-like. At its outer angle is the lachrymal fossa for the lachrymal gland. The depression for the Superior oblique muscle is at the inner angle. The **inner wall** is formed by four bones, (1) the nasal process of the superior maxillary; (2) the lachrymal bone; (3) the os planum of the ethmoid; (4) body of the sphenoid.

It has, (1) lachrymal crest; (2) groove for lachrymal sac; (3) ethmo-lachrymal suture; (4) ethmo-sphenoidal foramina.

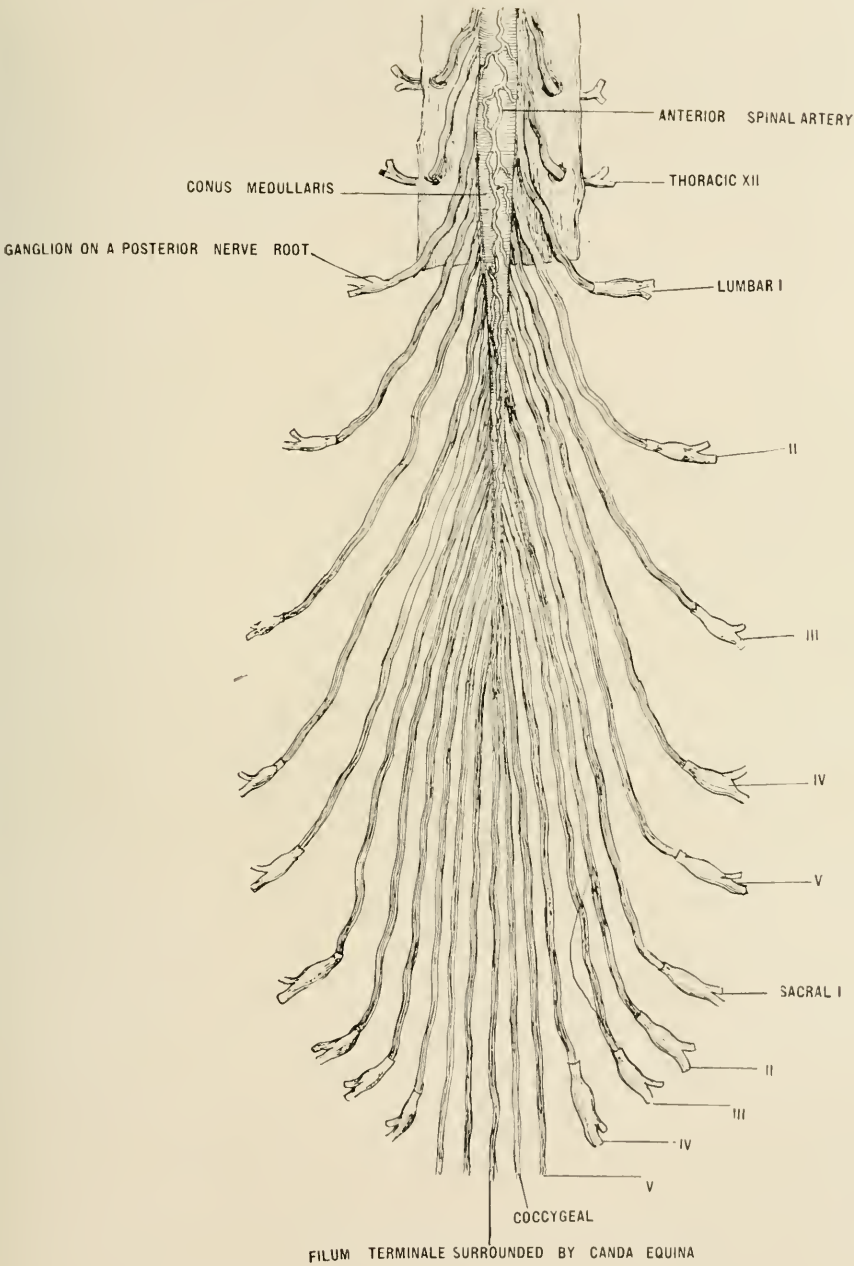
The **outer wall** is formed by two bones, the orbital process of the malar and the greater wing of the sphenoid bone. It presents (1) the opening of the malar canal, (2) speno-malar suture. The **four boundaries** of the orbit make four angles, viz., the **SUPERIOR EXTERNAL**, **SUPERIOR INTERNAL**, **INFERIOR EXTERNAL**, and **INFERIOR INTERNAL**. The **superior external angle** has (1) fronto-malar and

PLATE CXC.



SHOWING THE WRITING CENTER IN THE BRAIN.

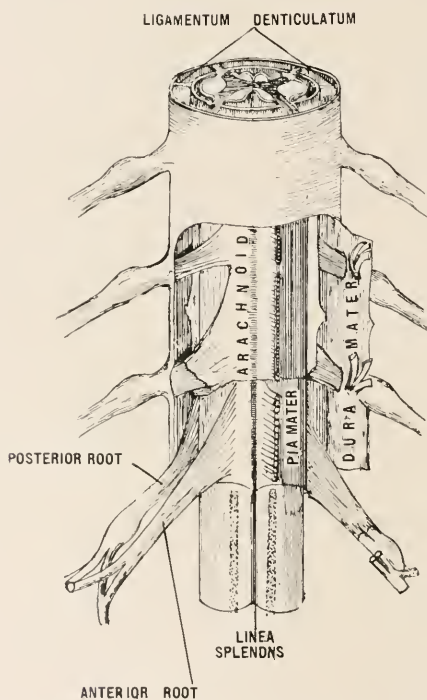
fronto-sphenoidal articulation, (2) the sphenoidal fissure which transmits the third, fourth, three divisions of the ophthalmic division of the fifth, and sixth nerves, filaments of the sympathetic, processes of the dura mater, orbital branches of the middle meningeal and recurrent lachrymal arteries.



ANTERIOR VIEW OF CAUDA EQUINA.

The **superior internal angle** has (1) the lachrymo-ethmo-frontal suture, anterior ethmoidal foramen which transmits the anterior ethmoidal vessels, and nasal nerve. (2) the posterior ethmoidal foramen which transmits the posterior ethmoidal vessels and sometimes a branch of the nasal nerve. The **inferior external angle** has the spheeno-maxillary fissure which is formed by the greater wing of the sphenoid bone externally and the superior maxillary bone and palate bone internally. This fissure connects the orbit with (1) the temporal fossa, (2) zygomatic fossa, (3) spheeno-maxillary fossa and transmits the infraorbital artery, superior maxillary nerve and its orbital branches and the ascending

PLATE CXII.



SHOWING THE DURA MATER, ARACHNOID, AND PIAMATER.

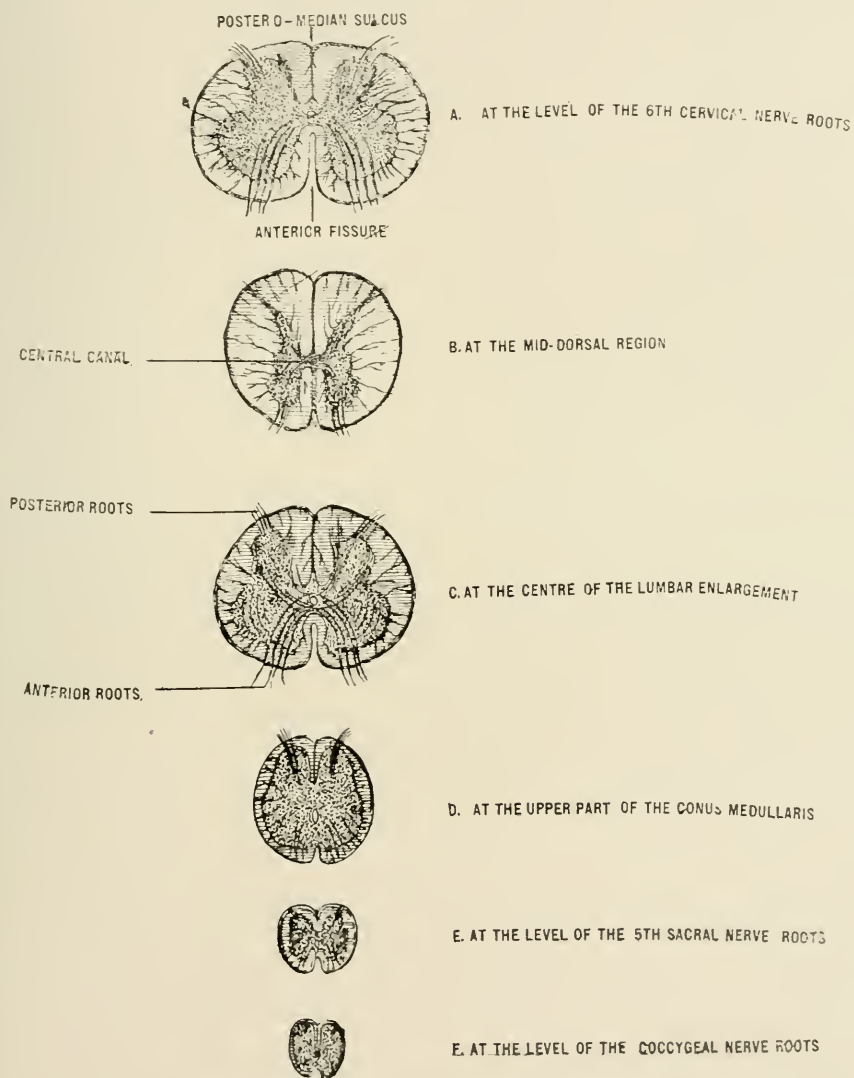
branches of Meckel's ganglion. The **inferior internal angle** has the ethmo-maxillo-palato-lachrymal suture. At the **apex of the orbit** is the optic foramen which is between the two roots of the lesser wing of the sphenoid. It transmits the optic nerve and ophthalmic artery, the nerve lying above and inner to the artery. The **LIGAMENT OF ZINN** is attached to the circumference of the optic foramen, deficient at the upper and outer part, and gives a common origin to the four Recti muscles. The **SUPRAORBITAL NOTCH OR FORAMEN** is situated at the junction of the inner and middle third of the upper circumference of the orbit. It transmits the supraorbital vessels and nerve. A line drawn from this notch or foramen to the mental foramen passes through the infraorbital foramen.

There are **EIGHT MUSCLES** in the orbit, viz., the four Recti, the two Oblique,

Levator palpebræ, and the Tensor tarsi (Horner's muscle).

1. PAPILLITIS is an inflammation of the optic papilla.
2. NEURORETINITIS is inflammation of the optic nerve and retina.
3. RETROBULBAR NEURITIS is an inflammation behind the eye-ball.

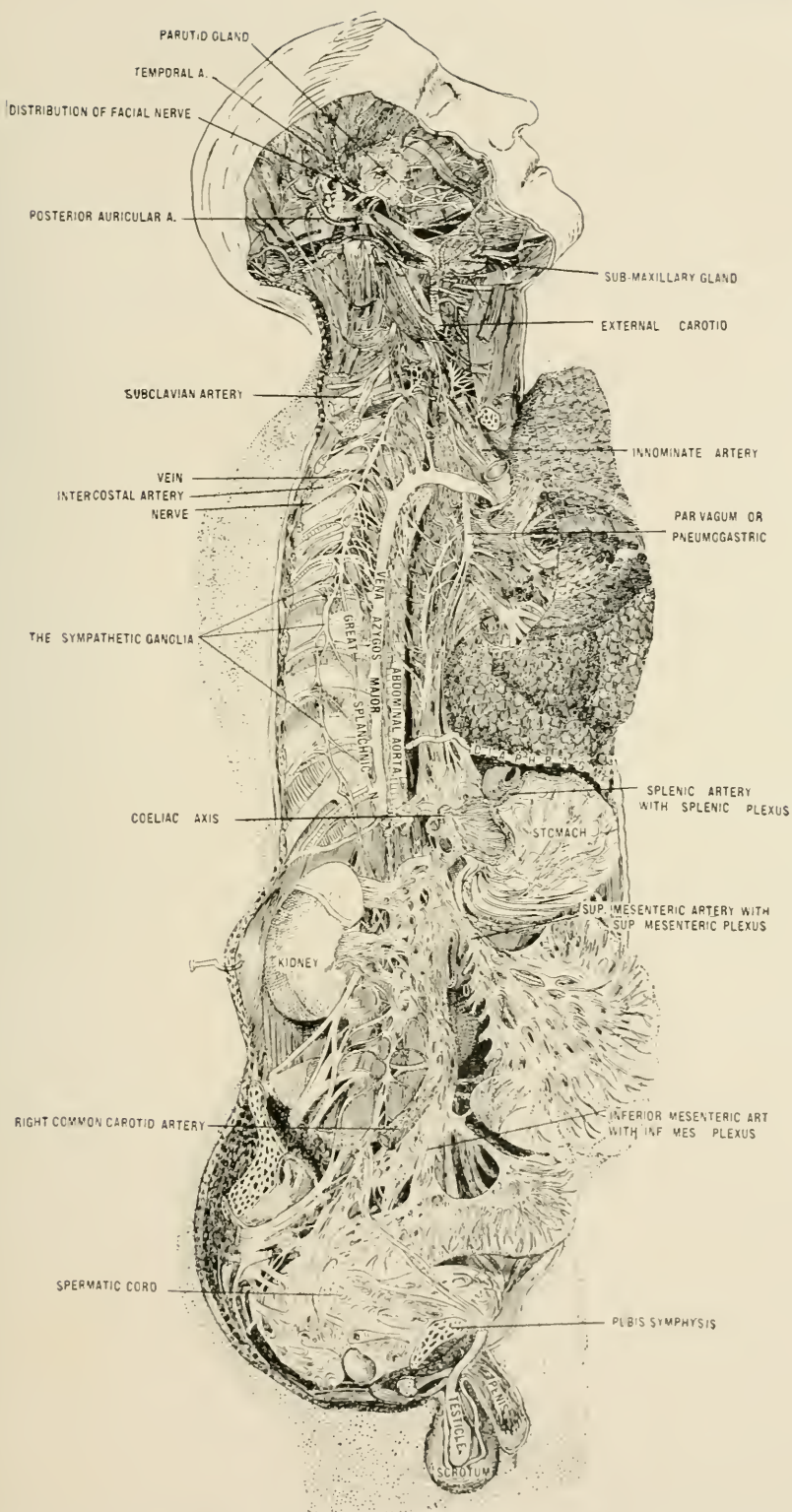
PLATE CXIII.



TRANSVERSE SECTIONS OF THE CORD AT DIFFERENT LEVELS.

4. AMBLYOPIA is a dimness of vision from imperfect sensation of the retina and without an organic lesion of the eye.

5. AMAUROSIS is blindness, especially blindness occurring without apparent lesion of the eye, from disease of the optic nerve, retina, spine or brain.



VENA AZYGOS MAJOR, ABDOMINAL AORTA AND SYMPATHETIC NERVE.

There are SEVEN MUSCLES in the orbital region, viz., (1) Levator palpebræ superioris, (2) Rectus superior, (3) Rectus inferior, (4) Rectus internal, (5) Rectus external, (6) Superior oblique, (7) Inferior oblique. All of these are attached to the eye-ball except the Levator palpebræ superioris. The **third** nerve supplies five of these seven muscles, all except the Superior oblique which is supplied by the **fourth**, and the External rectus which is supplied by the **sixth**. (Plate CCVI).

The **eye-ball** is spheroidal in shape, but consists of the segments of two spheres, a portion of the smaller sphere forming its anterior transparent part, and being set on the front of the posterior segment, which is a part of the larger sphere.

The **eye-ball** consists of three coats, sclerotic, choroid, and retina.

(a) The **SCLEROTIC COAT** is an opaque, white, dense, fibrous, inelastic membrane, continuous with the cornea in front, the two forming the external coat of the eye-ball.

(b) The **CHOROID** is a delicate, highly vascular membrane, forming one of the coats or tunics of the eye-ball, lining the sclerotic, and lying between it and the retina, with which it is in contact by its inner surface.

(c) The **RETINA** is the innermost and chiefly nervous coat of the posterior part of eyeball, between the choroid coat and vitreous humor. It may be divided into ten layers. (Plate CC).

The **eye-ball** has three refracting media, the aqueous humor, the crystalline lens, the vitreous humor.

(a) The **AQUEOUS HUMOR** is a limpid, watery fluid which fills the space between the cornea and the crystalline lens of the eye.

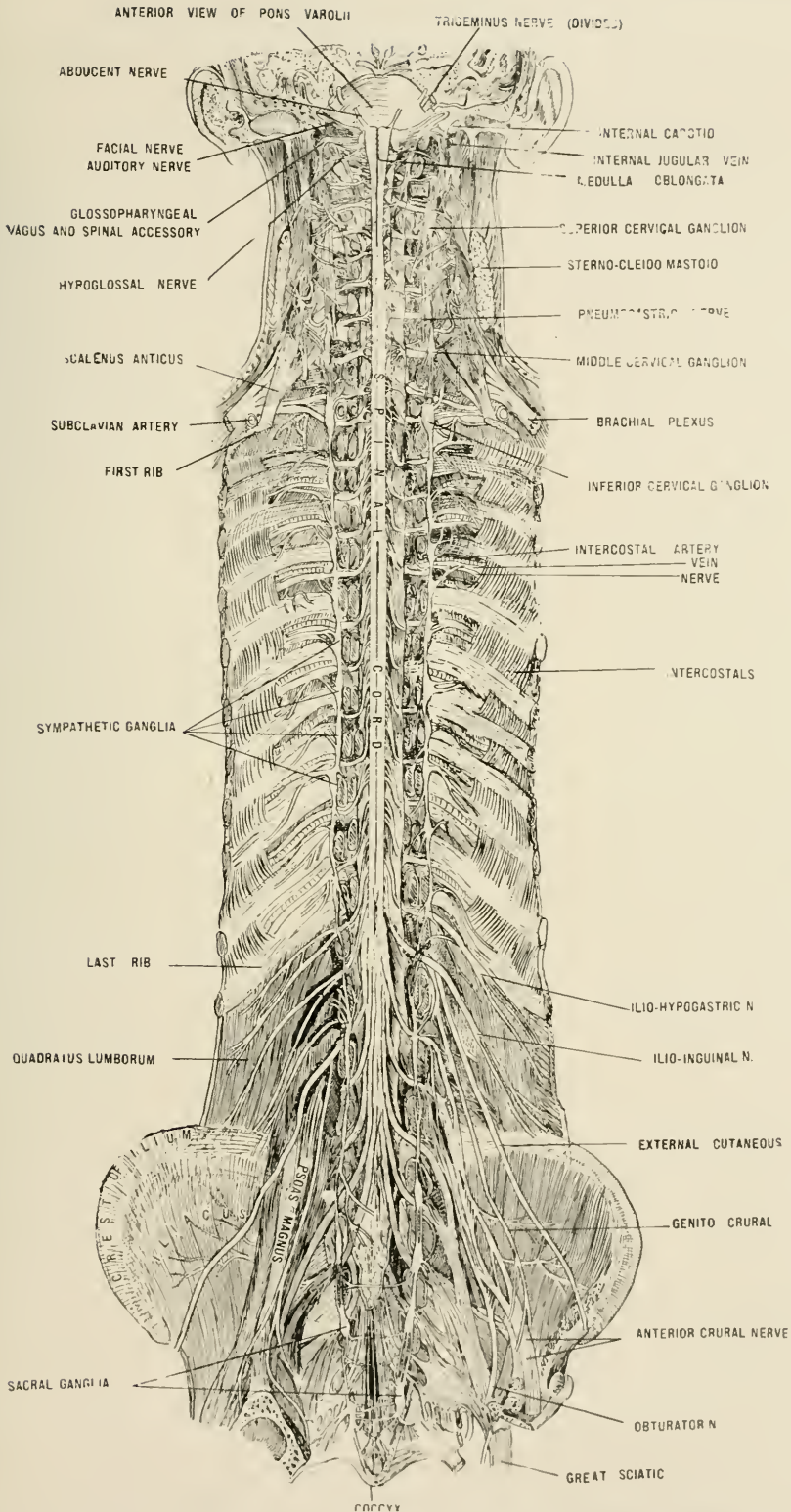
(b) The **CRYSTALLINE HUMOR OR LENS** is a lentiform pellucid body, composed of transparent firm substance, inclosed in a membraneous capsule and situated in front of the vitreous humor and behind the iris of the eye.

(c) The **VITREOUS HUMOR** is a pellucid gelatine substance which fills about four-fifths of the ball of the eye, behind the crystalline lens.

LESSON CVI.

The **eye-ball** is composed of three investing tunics and three refracting media. From without inward the tunics are (1) **fibrous**, consisting of (a) **SCLEROTIC** and (b) **CORNEA**; (2) **Vascular** (tunica vasculosa oculi), consisting of (a) **CHOROID**, (b) **CILIARY BODY**, and (c) **iris**; (d) **Nervous coat** or **retina** consisting of: (Plate CC).

1. Membrana limitans interna.
2. Fibrous layer, consisting of nerve-fibres.
3. Ganglionic layer, consisting of nerve-cells.
4. Inner molecular, or granular, layer.
5. Inner nuclear layer.
6. Outer molecular, or granular, layer.
7. Outer nuclear layer.
8. Membrana limitans externa.
9. Layer of rods and cones (Jacob's membrane).



ANTERIOR VIEW OF SYMPATHETIC NERVE AND SPINAL CORD

10. Pigmentary layer.

The **refracting media** are (1) AQUEOUS HUMOR, (2) VITREOUS HUMOR, and (3) CRYSTALLINE LENS.

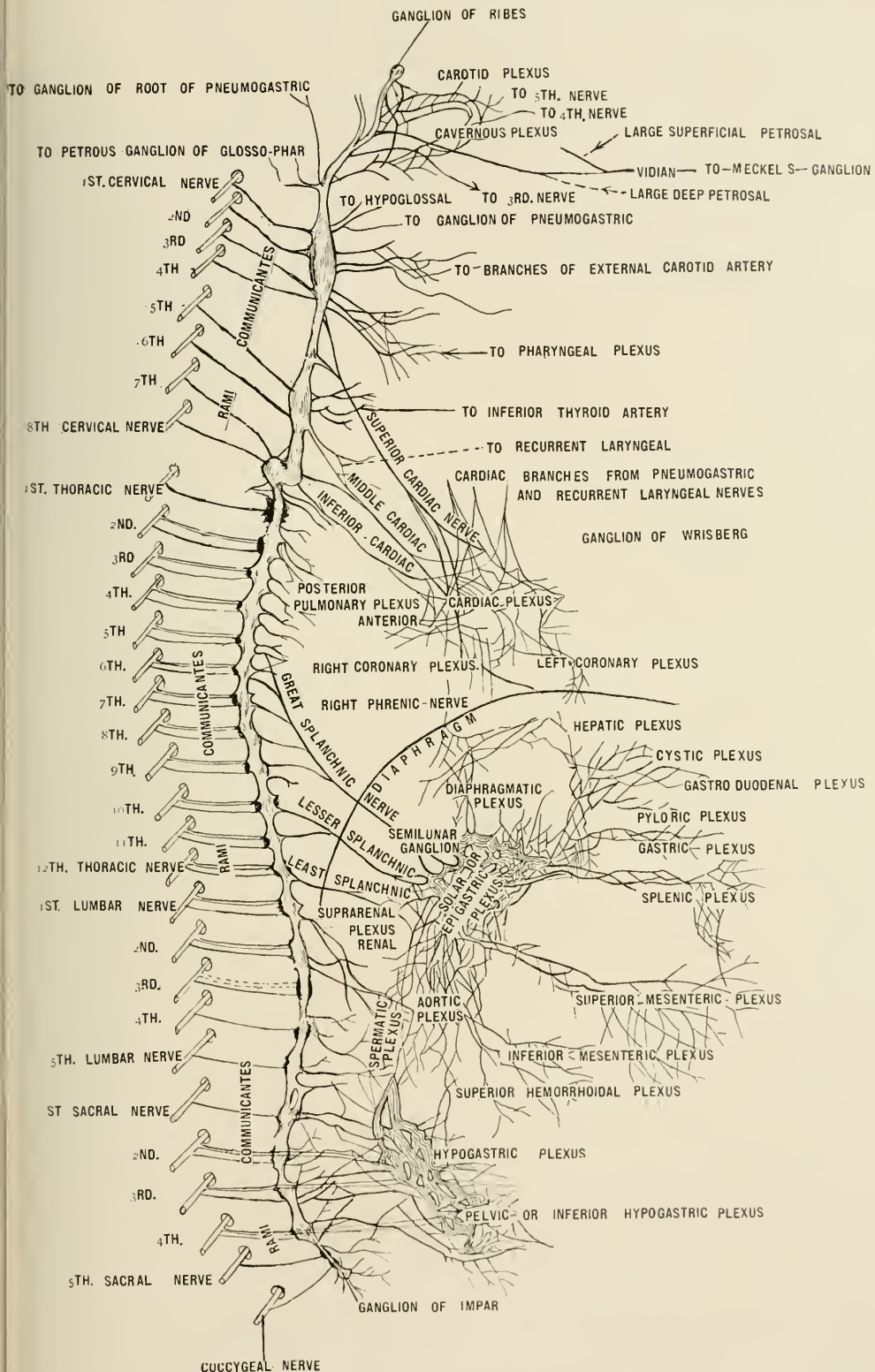
The **capsule of Tenon** is a layer of fascia which surrounds the posterior five-sixths of the eye-ball. Where the optic nerve enters it is continuous with the sclerotic coat. Anterior it is connected loosely to the sclerotic at the corneo-sclerotic junction. It is pierced by the tendons of the four Recti and two Oblique muscles of the eye. Between the anterior and posterior attachments there is a delicate attachment, between the capsule and the eye-ball, of connective tissue; these constitute extensively lymphatic spaces in which the eye-ball glides; this is a ball-and-socket (enarthrodial) joint. An **expansion** from the sheath of the Superior oblique muscle blends with the tendon of the Levator palpebræ. An **expansion** from the Inferior rectus is attached to the inferior tarsal plate, therefore these two Recti muscles influence the movements of the eyelids. The **expansion** of the sheath of the Internal rectus is attached to the lachrymal bone and is called the internal check ligament. The **expansion** from the External rectus which is very strong, is attached to the malar bone and is called the external check ligament. The **suspensory ligament** of the eye is attached to the malar and lachrymal bones, passing below the eye-ball; it is narrow at each extremity and broad in the center. The **ANTERIOR POLE** is the central point of the anterior curvature of the eye-ball; the **POSTERIOR POLE** is the central point of the posterior curvature. The **SAGITTAL AXIS** is a line joining these two poles. The **TRANSVERSE DIAMETER** of the eyeball is about one inch, the **VERTICAL** nine-tenths, and the **ANTERO-POSTERIOR** is intermediate.

The **sclerotic coat** is fibrous and opaque tunic, occupying the posterior five-sixths of the eye-ball. It is continuous in front with the cornea. The outer surface is white, being covered with conjunctiva. It is smooth, except where the muscles are inserted. Its inner surface is brown and marked by grooves for the ciliary vessels and nerves and is loosely connected to the outer surface of the choroid by fine cellular tissue (lamina fusca) thus forming the perichoroidal lymphatic spaces. The optic nerve passes through the posterior part of the sclerotic coat about one-eighth of an inch internal to the axis of the eye-ball.

The point of perforation is called the **lamina cribrosa**. The outer sheath of the optic nerve blends with the sclerotic coat at its entrance. The sclerotic is thickest at the posterior part of and thinnest about one-fourth an inch from the cornea. The canal of Schlemm, or sinus venosus scleræ, is close to the junction of the cornea with the sclerotic; it is a small circumferential lymphatic space. The structure of the sclerotic is white fibrous tissue intermingled with elastic tissue and flattened connective tissue corpuscles which are contained in the cell between the fibers. Some of the corpuscles are pigmented.

The nerves are from the ciliary, but their mode of ending is not known. The vessels are from the short and anterior ciliary arteries of the ophthalmic.

The **cornea** is transparent and forms about one-sixth of the circumference of the eye-ball anteriorly. It is a segment of a smaller sphere than that which forms the posterior five-sixths. It fits into the sclerotic coat somewhat like a watch crystal fits into the face of a watch, thus projecting beyond the curva-

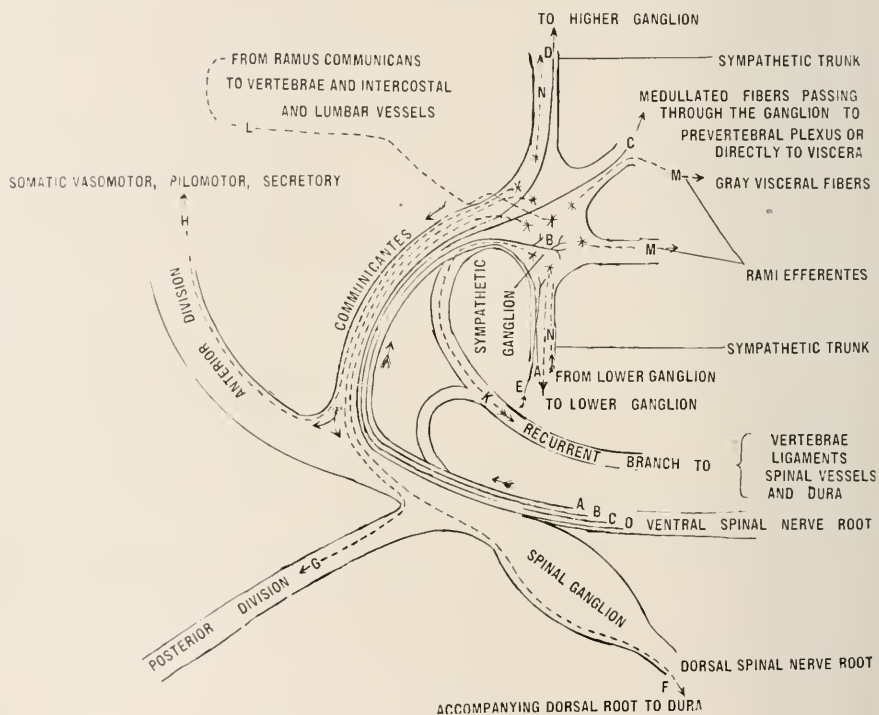


A SIDE VIEW OF SYMPATHETIC SYSTEM.

ture of the sclerotic. It is continuous with the sclerotic coat. The posterior surface of the cornea is concave and projects a little farther backward than the anterior convex surface. The posterior surface of the cornea forms the anterior boundary of the anterior chamber which contains aqueous humor. Its anterior surface is covered with conjunctiva which, in this position, constitutes one of the epithelial layers. It is of a uniform thickness and is more curved in youth than in old age, when it becomes flattened.

The **ligamentum pectinatum iridis** or the **pillars of the iris**, are formed by fibers from the stroma of the cornea which pass backward and outward to the iris. They form an annular meshwork encircling a series of lymphatic spaces

PLATE CXCVIII.



SHOWING THE RAMI COMMUNICANTES.

(spaces of Fontana) which communicate with the anterior chamber, and the canal of Schlemm, and the scleral veins.

STRUCTURE.—The cornea consists of four layers, viz: (1) **Several strata of epithelial cells** continuous with those of the conjunctiva. (a) The external set consists of columnar epithelium. (b) Two or three layers of polyhedral cells. (c) Three or four layers of scaly epithelial with flattened nuclei. (2) A **thick, central, fibrous structure** called the substance propria. It is fibrous, tough, unyielding, perfectly transparent and continuous with the sclerotic and consists of about sixty flattened lamellæ, the fibres passing one lamella to another. The corneal spaces are between the lamellæ, which are connected by an

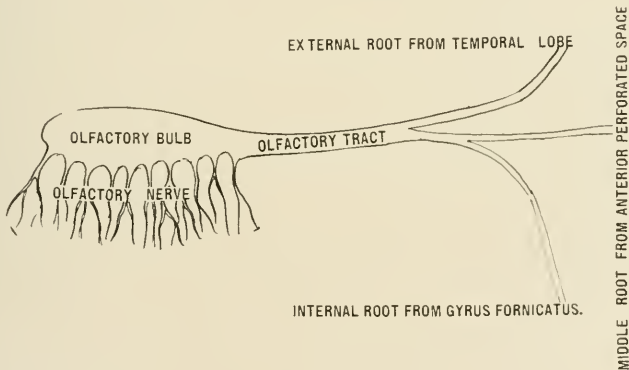
interstitial cement substance and each space contains cells, the corneal corpuscles which are stellate in shape. (3) A **homogenous elastic lamina**. (4) A **single layer of endothelial cells** forming part of the lining membrane of the anterior chamber of the eye-ball.

Besides **these four strata** we have the **ANTERIOR and POSTERIOR ELASTIC LAMINA**. The anterior elastic lamina (membrane of Bowman) is the uppermost layer of the corneal stroma immediately beneath the conjunctival epithelium. The posterior elastic lamina (membrane of Descemet or Demours) is the posterior lining membrane of the cornea. Its function is to preserve the correct curvature of the cornea proper. The nerves are numerous and are derived from the ciliary. It is non-vascular.

LESSON CVII.

The **choroid** consists of two layers, an outer and an inner. The inner layer or tunica Ruyschiana is formed by the capillary endings of the vessels of the outer coat. They pass forward to within one-eighth of an inch of the cornea

PLATE CXIX.

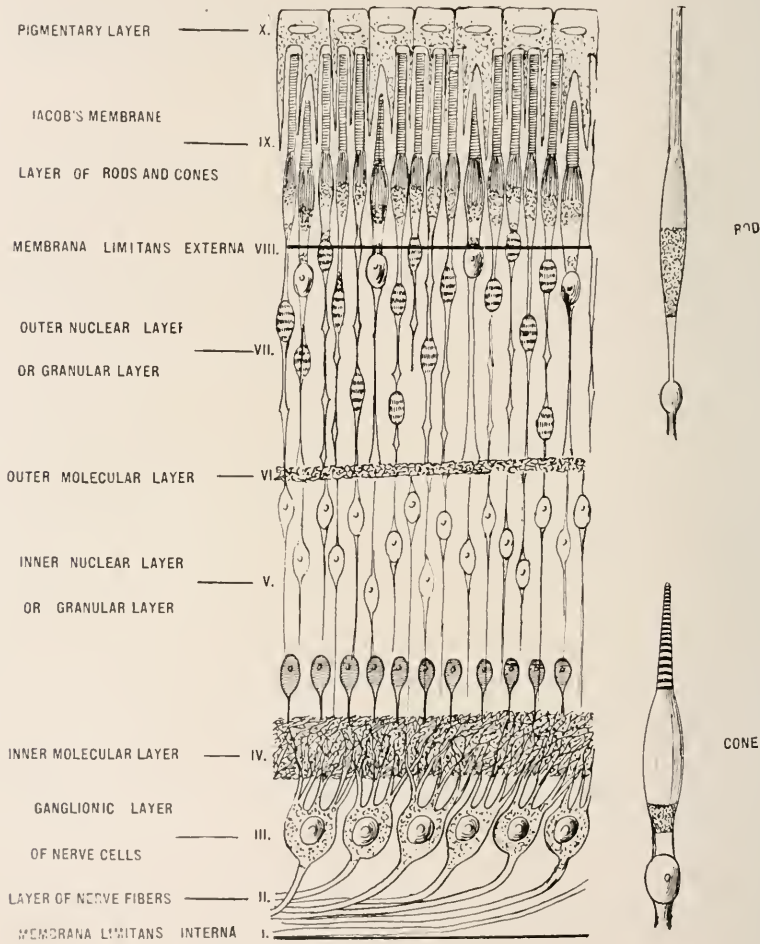


THE OLFACTORY OR FIRST CRANIAL NERVE.

joining those of the ciliary processes. The choroid consists of blood vessels connected together by loose connective tissue and containing large branched and pigmented cells. Externally it is connected to the sclerotic by loose connective tissue forming lymphatic spaces. It is a continuation of the pigmentary cells of the retina. The choroid is thickest behind where it is pierced by the optic nerve. The outer layer contains the larger branches of the vessels. The short ciliary arteries after piercing the sclerotic close to the optic nerve pass forward and inward to end in the inner layer of the choroid. The *venae vorticosæ*, which are four or five in number, are formed by numerous smaller veins and lie external to the arteries. They pierce the sclerotic midway between the cornea and the optic nerve. The *venae vorticosæ* form the two ophthalmic veins which join to form the common ophthalmic vein. The common ophthalmic vein passes from the orbit through the internal inferior angle of the sphen-

noidal fissure (anterior lacerated) into the cavernous sinus which divides into superior and inferior petrosal sinuses, each of which empties into the lateral sinus. The lateral sinus and inferior petrosal sinus form the internal jugular vein. This vein receives the sub-lavian vein thus forming the innominate vein. The two innominate veins form the superior vena cava which empties into the right auricle of the heart. Thus the blood passes from the eye-ball to the heart.

PLATE CC.



THE LAYERS OF THE RETINA.

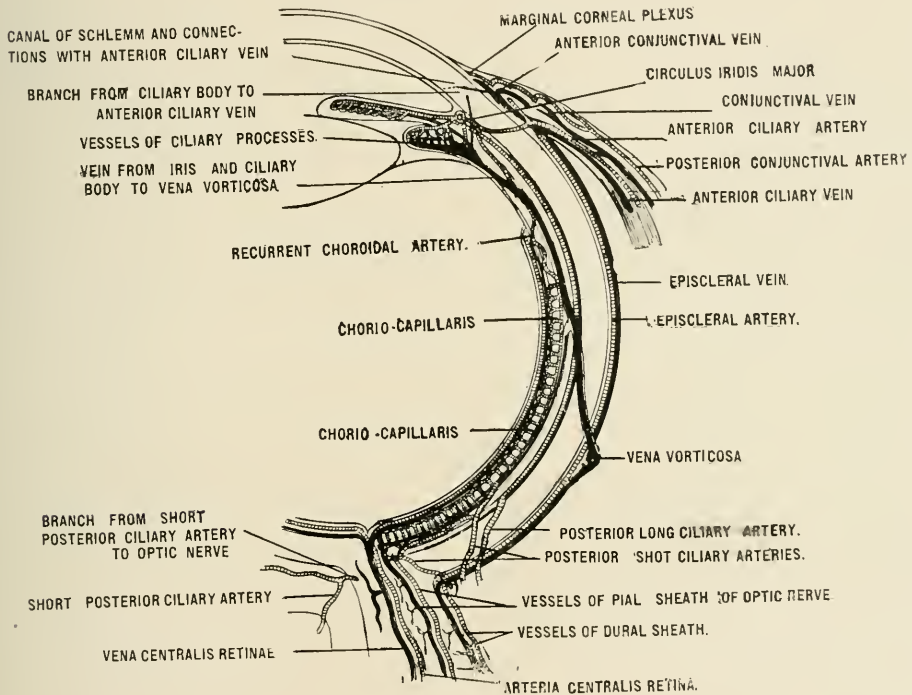
The arterial blood passes from the heart to the eye-ball as follows:

From the left ventricle through the arch of the aorta through which it passes into the common carotid—on the right side it must first go through the innominate artery—from the common carotid into the internal carotid by means of which it which passes into the skull through the carotid canal and middle lacerated foramen. Then the internal carotid gives off the ophthalmic

artery which passes through the optic foramen into the orbit with the optic nerve. However, this artery sometimes passes with the ophthalmic vein through the anterior lacerated or sphenoidal fissure. In the orbit it gives off the following branches, an orbital group and an ocular group. The **branches of the orbital group are:**

- | | | |
|------------------------|------------------------|-------------------------|
| 1. Lachrymal. | 2. Supraorbital. | 3. Posterior ethmoidal. |
| 4. Anterior ethmoidal. | 5. Internal palpebral. | 6. Frontal |
| 7. Nasal. | | |

PLATE CCI.



BLOOD SUPPLY TO THE EYE-BALL. (LEBER).

The **ocular group** consists of:

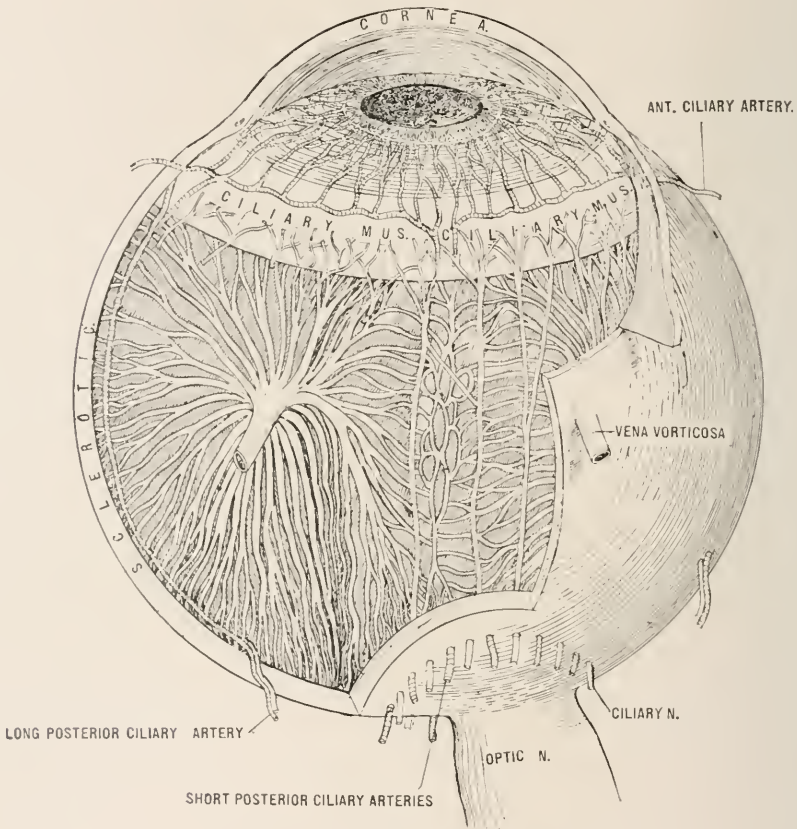
- | | |
|------------------|-------------------------------|
| 1. Short ciliary | 3. Anterior Ciliary. |
| 2. Long ciliary | 4. Arteria centralis retinae. |
| 5. Muscular. | |

The **lachrymal** is one of the largest branches from the ophthalmic and comes off close to the optic foramen although it may come off before the artery passes through the optic foramen. Occasionally it is derived from one of the anterior branches of the middle meningeal artery. It passes along the outer wall of the orbit above the External rectus muscle with the lachrymal nerve. It is distributed to the lachrymal gland and to the eyelids and conjunctiva. Those to the lids are two in number, called the external palpebral running in the

upper and lower lids, uniting with the internal palpebral. It gives off one or two malar branches, one of them pass through the malar foramen to anastomose with the transverse facial, the other passes through a foramen in the malar bone to anastomose with the deep temporal in the temporal fossa. A branch from the lachrymal passes through the sphenoidal fissure to the dura mater to anastomose with the middle meningeal artery. (Plate CCIII).

The **supraorbital artery** arises above the optic nerve and passes above the

PLATE CCII.



SHOWING VENE VORTICOSE.

muscles and beneath the roof of the orbit onto the forehead through the supra-orbital foramen with the supraorbital nerve. While in this foramen it gives off a branch to the diphr. After leaving the foramen it divides into superficial and deep branches. It supplies muscles, integument and the pericranium on the forehead. It anastomoses with the frontal, anterior temporal, artery of the opposite side, and angular artery. It supplies the parts at the inner canthus. The Superior rectus and Levator palpebræ are supplied by it.

The **posterior ethmoidal** is smaller than the anterior ethmoidal. It enters the posterior ethmoidal foramen, supplying the posterior ethmoidal cells, giving

off a branch to the dura mater and a nasal branch which passes through the cribriform plate of the ethmoid anastomosing with branches of the sphenopalatine.

The **anterior ethmoidal** accompanies the nasal nerve through the anterior ethmoidal foramen into the cranium, supplying the anterior ethmoidal cells and frontal sinus. It gives meningeal branches to the dura mater and passes through the nasal slit to be distributed under surface of the nasal bone and the skin of the nose.

The **internal palpebral** are two in number, coming from the ophthalmic opposite the pulley of the Superior oblique. These pass between the dorsal cartilages and the Orbicularis palpebrarum.

The **frontal artery** is one of the terminal branches. It passes upward at the inner angle of the eye anastomosing with the supraorbital and the artery of the opposite side, to be distributed to the integument, muscles, and pericranium.

The **nasal branch** is another terminal branch. It leaves the orbit above the tendo oculi. It gives branches to the lachrymal sac. Its transverse nasal branch anastomoses with the angular and its dorsalis nasi supplies the outer surface of the nose and anastomoses with the artery of the opposite side and lachrymal branch of the facial.

The **ciliary arteries** are the short, long, and anterior. The short ciliary are eight or ten in number. They come from the ophthalmic or some of its branches. They pierce the sclerotic coat forming a circle around the optic nerve, passing forward on the inner surface of the choroid, supplying the choroid coat and the ciliary processes. The long ciliary are two in number which pierce the sclerotic coat running forward to form two arches, the *circulus major* which is around the circumference of the iris and the *circulus minor* around the papillary margin. The anterior ciliary come from the muscular branches and pass forward with the tendons of the Recti muscles. They form a network beneath the conjunctiva and pierce the sclerotic coat a short distance from the cornea to join the *circulus major* at the iris.

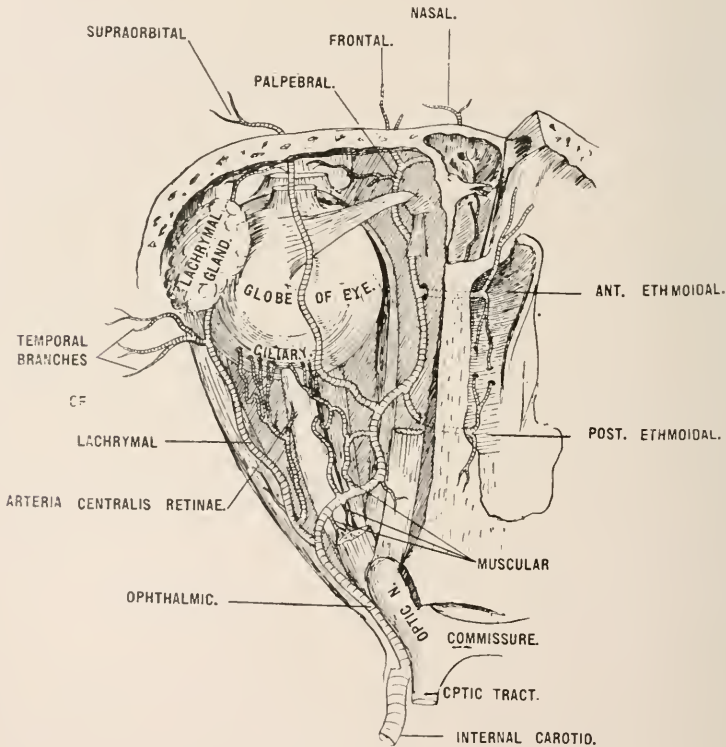
The **arteria centralis retina** pierces the optic nerve obliquely about one-fourth an inch behind the eye-ball. It is one of the smallest branches of the ophthalmic. It enters the globe of the eye-ball through the *porus opticus*. It supplies the inner surface of the retina and is accompanied by the corresponding veins. In the fetus a branch passes from this artery through Stilling's canal to the capsule of the lens. It lies beneath the sheath before it pierces the nerve.

LESSON CVIII.

Muscular branches are given off from various branches of the ophthalmic and are two in number, the superior and inferior. They may come from the common trunk. The superior one supplies the Superior rectus, Levator palpebræ, and Superior oblique. The inferior one supplies the Inferior rectus, External rectus, Internal rectus, and Inferior oblique. This inferior one gives off one of the anterior ciliary branches. Muscular branches are also given off from the lachrymal, supraorbital, and the ophthalmic itself.

The **ciliary body** consists of the ciliary processes and the ciliary muscle. The ciliary processes are of the same structure as the rest of the choroid. They are a series of folds (seventy or eighty) which are derived from the anterior margin of the choroid and are received in the corresponding folds of the suspensory ligament of the lens and the vitreous humor. The blood supply is the anterior ciliary. The ciliary muscle consists of two sets of involuntary muscular fibers, radiating and circular. It has a circular band one-eighth of an inch wide on the outer surface of the choroid in front. The radiating fibers are more numerous and more external arising from the sclerotic close to the junction of the sclerotic and the cornea, between the spaces of Fontana and the canal of Schlemm and pass backward to be inserted in the choroid opposite the ciliary processes. The circular fibers are internal to the radiating at the base of the ciliary processes surrounding the iris.

PLATE CCHII.



DISTRIBUTION OF OPTHALMIC ARTERY.

The **iris** is a thin, fibrous, and contractile circular membrane which gives color to the eye. It is suspended in the aqueous humor between the cornea in front and the lens behind. The pupil is an aperture in its center. It is continuous at the circumference with the choroid and anterior to this it is connected to the cornea by the pillars of the iris or ligamentum pectinatum. It is also connected to the ciliary muscle. The uvea or the posterior surface is marked

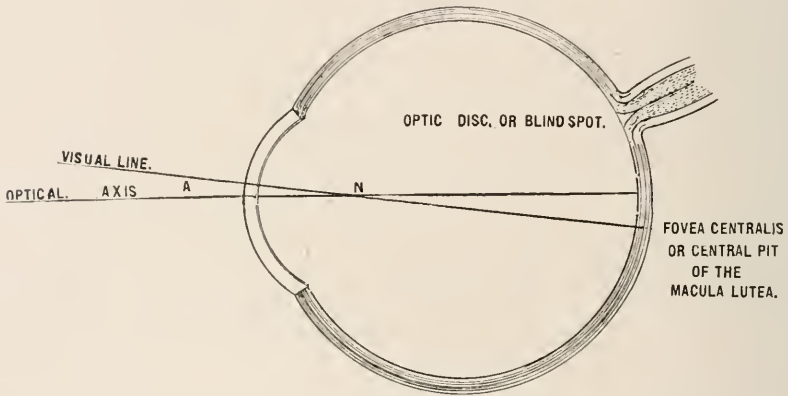
with folds prolonged from the ciliary processes and is darkly pigmented. The anterior surface is colored and marked by wavy lines which converge towards the free edge of the pupil. This surface is covered by a layer of epithelium which is continuous with that of the membrane of Descemet. The frame work of the iris is a delicate stroma which consists of connective tissue containing blood vessels, nerves, pigment cells, and muscular fibers (involuntary). The first, sphincter fibers which form a circular narrow band pass to the pupil and receive the third nerve. This band is about one-thirtieth of an inch in thickness. The second, dilator, which are radiating, commence at the outer margin of the iris, converging towards its center to join the circular one near the pupil. Some say these are elastic and not muscular. It receives the sympathetic nerve. The blood supply is from the long and anterior ciliary and the vessels of the ciliary processes. Nerve supply from the ciliary branches of the lenticular ganglion and long ciliary branches of the nasal nerve which is a branch of the ophthalmic division of the fifth. The nerves form a plexus around the margin. The membrana pupillaris is a delicate transparent vascular membrane which closes the pupil in the fetus. It disappears about the seventh month.

The **retina** ends behind the ciliary muscle in an irregular margin, the ora serrata. The pars ciliaris (radiating fibers of Muller covered by pigmented layers) is a thin membrane passing from the ora serratus to the iris. The macula lutea is the most perfect point of vision. It is situated at the center of its inner surface behind. It has a depression called the fovea centralis. The porus opticus of the optic nerve is pierced by the arteria centralis retinae and is one-tenth of an inch internal to the macula lutea. Muller's fibers are connective tissue fibers which bind the layers of the retina together. The aqueous humor fills the anterior and posterior aqueous chambers which are situated between the posterior surface of the cornea and the anterior surface of the iris and between the posterior surface of the iris and the anterior surface of the crystalline lens. It is a slightly alkaline fluid. The lens is in contact anteriorly with the iris; posteriorly it rests in the depression of the vitreous humor, fovea pupillaris. It is surrounded by a capsule-zonule of Zinn which is derived from the hyaloid membrane. The lens is about one-fourth of an inch antero-posteriorly and one-half transversely. It is a transparent, solid, biconvex body composed of concentric laminae and is hardest at the center. The vitreous humor occupies about four-fifths of the eye-ball resting upon the retina behind and is hollowed out in front the fossa pupillaris for the lens. It is a soft, gelatinous substance and surrounded by transparent hyaloid membrane. It fills the cavity of the retina. The canal of Stilling runs through its center from the porus opticus to the lens and is lined by a prolongation of the hyaloid membrane. This canal is filled with fluid. In the fetus an artery runs from the arteria centralis retinae to the capsule of the lens. At the pars ciliaris this membrane divides sending a layer behind the capsule and one in front; the anterior one is the suspensory ligament of the lens. It contains elastic fibers. The canal of Petit surrounds the lens. (Plate CC).

The **lachrymal gland** (Plate CCV) resembles serous salivary glands. It is situated internal to the external angular process in a depression in the orbital plate of

the frontal bone resting on the eye-ball and the Superior rectus and External rectus muscles. It is about the shape and size of an almond. It is constricted in the center. The ducts, about seven, pass through the conjunctiva, opening on the outer part of the upper lid. The lachrymal canals, two in number, begin at the puncta lachrymalia in each lid, the superior one passing upward and then inward to join the inferior one which passes downward and then inward. They empty into the lachrymal sac together. The lachrymal sac lies in a groove formed by the lachrymal bone and nasal process of the superior maxillary. It is the dilated upper part of the nasal duct. It is crossed by the Tensor tarsi and is covered by an expansion from the tendo oculi. The duct is about one-half an inch long and directed downward, slightly outward and backward. It is formed by the lachrymal, superior maxillary, and inferior turbinated bones. It extends from the lachrymal to the inferior meatus of the nose where it opens. The opening has a valve formed by the mucous membrane.

PLATE CCIV.



OPTICAL AXIS AND VISUAL LINE.

LESSON CVIX.

The **conjunctiva** (joined together) which unites the eyelids and the eye-ball is a mucous membrane. It lines each eyelid at the base of which it is reflected on the eye-ball. The lines of reflection are the fornices. The superior one is the deeper and some of the fibers of the Levator palpebræ are inserted into it. The conjunctiva is loosely attached to the sclerotic cord, but at the outer margin of the cornea it is firmly attached, passing over the cornea, forming its inferior epithelial layer. The ducts of the lachrymal gland open into the conjunctival sac above and the opening of the lachrymal canaliculi at the puncta lachrymalia below. The palpebral conjunctiva is sensitive, vascular and thick. Part of the eye-ball or ocular conjunctiva is thin, transparent and is only slightly vascular in the healthy condition. The plica semilunaris is a fold of conjunctiva at the inner canthus of the eye. It is the rudimentary homologue of the membrana Nictitans (third eyelid) in birds. (Plates CCV-CCIX).

The **eyebrows** (supercilia) are two arched eminences over each orbit, consisting of thickened integument and muscles and are covered by thick hairs. Each one is connected with the Orbicularis palpebrarum, Corrugator supercillii, and Occipito-frontalis.

Eyelids. The upper one is more movable than the lower one. When closed they protect the eye-ball from injury. Where the upper and lower lids meet when open they form the outer and inner canthus. The lacus lachrymalis is a small triangular area in the inner canthus in which is a mass of fat (pink) connective tissue. This mass is caruncula lachrymalis and it is separated from the eye-ball by a vertical fold of conjunctiva, the plica semilunaris which is a rudimentary third eyelid.

The **eyelashes** (cilia) are short, thick hairs which form a double row at the free margin of each lid. Those of the upper lid are longer and more numerous than those of the lower lid. Each eyelid has the following structures from without inward: (1) Skin, (2) areolar tissue, (3) Orbicular muscle, (4) tarsal plate, (5) palpebral ligament, (6) Meibomian glands, (7) conjunctiva. The upper lid has in addition the aponeurosis of the Levator palpebræ which is attached to the upper surface of the tarsal plates.

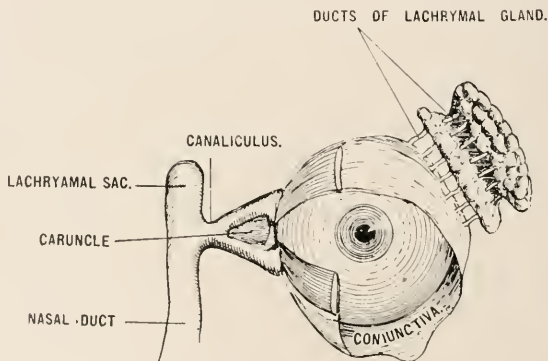
The **tarsal plates** are in each lid and are formed by lamina of a dense connective tissue. The upper one is the larger; it is half oval in shape while the lower one is a narrow oblong slit.

The **Meibomian glands** are lodged in these plates. The palpebral ligaments are at the outer and inner angle of the eye, forming attachments for the Orbicularis palpebrarum muscle. They form an imperfect diaphragm for the anterior orifice of the orbit. Peripherally they are attached to the orbital margin and centrally to the edges of the tarsal plates. (See Plate CCXII.)

The **third or motor oculi** has its **SUPERFICIAL ORIGIN** in front of the pons on the inner side of the crus cerebri. Its **DEEP ORIGIN** is situated on each side of the median line on the floor of the aqueduct of Sylvius, after passing through the substantia nigra and the tegmentum of the crus. All the muscles of the orbital region are supplied by the third nerve except the Superior oblique, which receives the fourth nerve and the External rectus, which receives the sixth. This nerve also supplies the sphincters of the iris and the ciliary muscle through its connection with the ciliary ganglion. **Remember** that the External rectus of one eye and the Internal rectus of the other eye have their nerve supply from the same nucleus. The nucleus of the third nerve receives the fibers from that of the sixth nerve of the opposite side; **this** accounts for the fact that one can move both eyes to the right or left at the same time. From this deep origin of the third nerve each muscle supplied by it has its own set of cells. Then from behind forward their position is (1) those cells to the Internal rectus; (2) to the Levator palpebræ; (3) the Superior rectus; (4) the Inferior rectus; and (5) the Inferior oblique. In front of these are the nuclei of the fibers for accommodation and for sphincter pupillæ. It is covered with pia mater and arachnoid on leaving the brain. It pierces the dura mater anterior and external to the posterior clinoid process after having passed between the superior cerebellar and the posterior cerebral arteries. It then passes through the cavernous sinus

above the other orbital nerves. In this position it communicates with the ophthalmic division of the fifth and with the cavernous plexus. Before entering the sphenoidal fissure it divides into two branches, a superior and an inferior one, with the nasal branch of the fifth nerve between them. (Plate CCXXIV). **All the structures** on the lower border of the sphenoidal fissure are between the two heads of the External rectus muscle. The superior branch is the smaller. It passes forward over the optic nerve and supplies the Levator palpebræ and Superior rectus muscles. The inferior branch supplies three muscles; the division which goes to the Internal rectus passes beneath the optic nerve; the second division passes to the Inferior rectus, and the third or lower division passes to the Inferior oblique between the External rectus and the Inferior rectus. This division to the Inferior oblique sends a motor branch to the Inferior rectus. The branches of the third nerve enter their muscles on the orbital surface except the branch to the Inferior oblique which enters on the posterior border. **This third nerve** may supply the anterior belly of the Occipito-frontalis,

PLATE CCV.



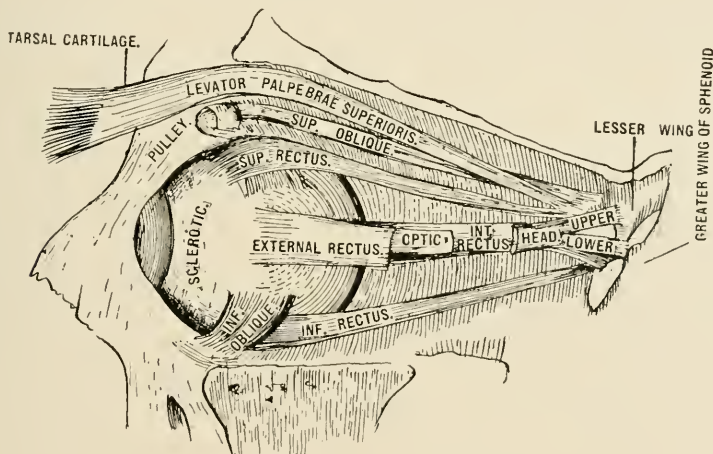
NASAL DUCT, CONJUNCTIVA, AND LACHRYMAL GLAND.

the Corrugator supercilii, and the Orbicularis palpebrarum. These muscles are generally supplied by the seventh, but they have escaped paralysis in lesions of the nuclei of the seventh nerve. From the nucleus of the third nerve some fibers which descend in the posterior longitudinal bundle join the facial nerve just before it leaves the pons; these fibers supply the three muscles above mentioned. **Paralyses** of the third nerve may be only in part as any fibers to one muscle or it may be the whole nerve. When the whole nerve is paralyzed the following result: (1) **PROMINENCE OF THE EYE-BALL** because most of the muscles are relaxed. (2) **EXTERNAL STRABISMUS**, the eye-ball being drawn outward because the External rectus which is supplied by the sixth is not paralyzed. (3) **PTOSIS** because the Levator palpebræ is paralyzed. (4) **LOSS OF ACCOMMODATION** because the Internal rectus, the ciliary muscle, and the sphincter pupillæ are paralyzed. (5) **DILATATION OF THE PUPIL** because the sphincter fibers of the iris are paralyzed.

LESSON CX. (Plate CCXIII).

The **fourth cranial nerve** or **Pathetic** or **Trochlear**, has its **SUPERFICIAL ORIGIN** in the valve of Vieussens behind the corpora quadrigemina. The two nerves decussate on the upper surface of the valve. Its **DEEP ORIGIN** is in the floor of the aqueduct of Sylvius. This nerve can be seen on the base of the brain on the outer side of the crus cerebri, just in front of the pons. It is the **smallest** of all the cranial nerves but has the **longest** intercranial course. Coming from the upper end of the valve of Vieussens this nerve crosses the superior peduncles of the cerebellum and the crusta of the mid-brain, just beneath the pons, then it pierces the dura mater in the free border of the tentorium, immediately behind and external to the posterior clinoid process. From this point it passes forward in the outer wall of the cavernous sinus between the third nerve and the ophthalmic division of the fifth (See Plate CCXXXII); it then crosses the

PLATE CCVI.

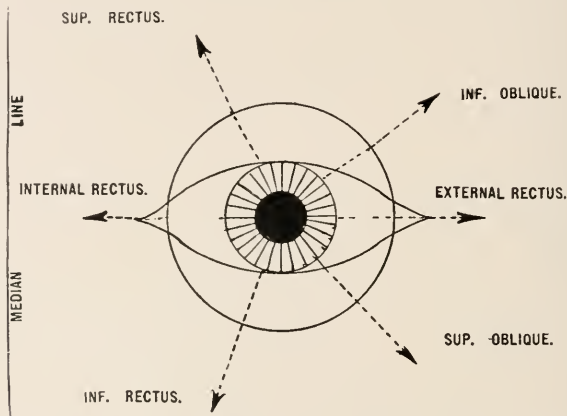


THE MUSCLES OF THE ORBITAL REGION.

third nerve and enters the orbit through the sphenoidal fissure (anterior lacerated); in this fissure it is the highest of all the nerves (See Plate CCXXIV) being situated at the upper and inner angle, internal to the frontal nerve. In the orbit it passes inward above the origin of the Levator palpebræ to enter the orbital surface of the Superior oblique. In the cavernous sinus it communicates with the ophthalmic division of the fifth, with the ciliary plexus, and sends a recurrent branch backward between the layers of the tentorium as far as the lateral sinus. While in the anterior lacerated fissure it may send a branch to the lachrymal nerve. If the fourth nerve is paralyzed the function of the Superior oblique is lost and one cannot turn the eye-ball DOWNWARD AND OUTWARD. Should one attempt to do so the eye is twisted inward producing double vision, DIPLOPIA.

The **sixth nerve** or **Abducent** has its **SUPERFICIAL ORIGIN** from the lower part of the pons in the groove between the pyramid and the pons or in the constricted part of the pyramid. Its **DEEP ORIGIN** is in the floor of the fourth ventricle close to the median line and a little lower than that of the motor root of the fifth. This origin is traced to a nucleus under the upper half of the funiculus teres. This nerve enters the cavernous sinus after the dura mater of the basilar process of the sphenoid, running through a notch immediately below the posterior clinoid process. In the cavernous sinus it lies external to the internal carotid artery. From this sinus it enters the orbit between the two heads of the External rectus to supply this muscle, entering the muscle on the orbital surface.

PLATE CCVII.



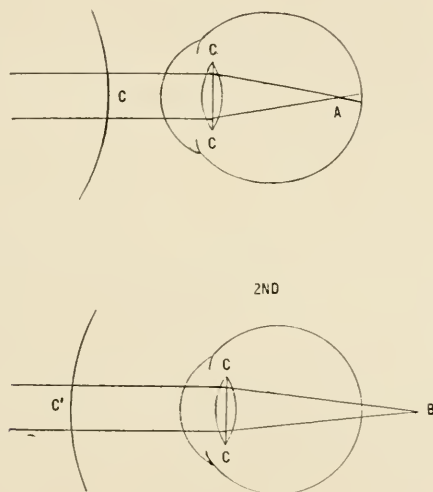
SHOWING THE DIRECTIONS THAT MUSCLES OF THE EYE-BALL MOVE THE EYE.

For its position in the sinus (See Plate CCXXXII.) All the structures on the floor of the sphenoidal fissure lie between the two heads of the External rectus. For position of the nerves in the orbit (See Plate CCXV). The fourth nerve lies on the Superior oblique, the frontal nerve on the Levator palpebrae, and the lachrymal nerve on the External rectus. The superior division of the third nerve lies along the Superior rectus; the nasal nerve crosses the optic nerve from without inward; the optic nerve is surrounded anteriorly by the ciliary nerves; the lenticular ganglion lies between the optic nerve and the External rectus. The sixth nerve is on the outer surface of the orbit. The inferior division of the third nerve is below the lenticular ganglion and this nerve is joined by filaments from the cavernous plexus, carotid plexus, and the ophthalmic nerve. If the sixth nerve is paralyzed **INTERNAL** or **CONVERGENT SQUINT** follows as the External rectus loses its function. The pupil is contracted to some extent in paralysis of this nerve as some of the sympathetic fibers to the radiating muscle of the iris pass along this nerve.

The **fifth nerve** is the largest of the cranial nerves. It is more like a **SPINAL NERVE** than any other of the cranial nerves. It is a compound nerve, having

an anterior or motor, and a posterior or sensory root with a ganglion upon it. It is called the **TRIFACIAL** or **TRIGEMINUS**. Its **SUPERFICIAL ORIGIN** is on the side of the pons, nearer the upper than the lower border. Its motor fibers, which are three or four bundles, are separated from the sensory fibers, which are seventy to one hundred bundles, by a few transverse fibers. The **DEEP ORIGIN** is in the floor of the fourth ventricle. Its **sensory portion** is in a nucleus in the pons just below the floor and just beyond the margin of the upper half of the fourth ventricle. The **motor portion** is a nucleus internal to the sensory and external to the funiculus teres on the upper half of the floor. (Plates CCXIV-CCXV).

PLATE CCVIII.



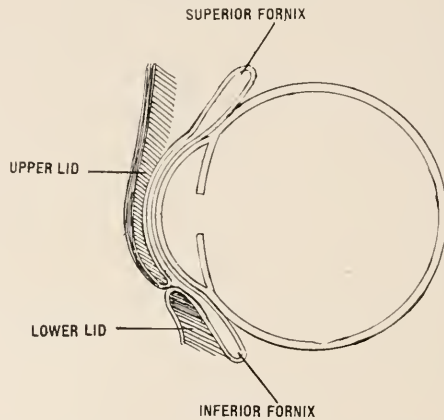
SHOWING REFRACTION OF LIGHT THROUGH CRYSTALLINE LENS.

It is the **SENSORY NERVE** to the **head** and **face**, and a **MOTOR NERVE** to the **muscles of mastication**. Its roots pass through an oval opening in the dura mater near the apex of the petrous portion of the temporal bone. The sensory root is from the Gasserian ganglion, which is situated in Meckel's cave. This cave is a depression near the apex of the anterior surface of the petrous portion of the temporal bone. The anterior or motor root passes under the Gasserian ganglion and is not joined to it but joins the inferior maxillary division of the fifth after it passes through the foramen ovale, thus making this part of the nerve a compound nerve; in fact it is the only part of the fifth nerve which is a compound nerve for the other two divisions are purely sensory. This ganglion gives off from its anterior edge three trunks, (1) **Ophthalmic**, (2) **Superior maxillary**, and (3) **Inferior maxillary**. It sends communicating branches to the carotid plexus, tentorium, cerebellum, and the dura mater of the middle fossa.

I. The **ophthalmic branch** purely sensory, is the smallest and courses along the outer wall of the cavernous sinus below the third and fourth nerves. It divides into three branches which leave the cranium through the anterior lacerated or sphenoidal fissure. (For relation of these branches see Plate CCXXIV.) These branches are the frontal, nasal, and lachrymal. The ophthalmic supplies the eye-ball, the lachrymal gland, the orbital and nasal mucous membrane and skin of the eyebrow, forehead, and nose.

The **FRONTAL BRANCH** is the largest and is just external to the fourth nerve and the anterior lacerated or sphenoidal fissure and passes forward on the Levator palpebræ, dividing into two branches.

PLATE CCIX.



SUPERIOR FORNIX AND INFERIOR FORNIX OF CONJUNCTIVA.

LESSON CXI.

(a) The **SUPRAORBITAL** which passes through the supraorbital foramen or notch. It gives a branch to the diploë and mucous membrane of the frontal sinus. The outer and inner branches supply twigs to the pericranium and pierce the Frontalis muscle. They communicate with branches from the facial nerve and are distributed to the skin of the scalp in the frontal and parietal regions. The outer branch is the larger and passes backward almost to the lambdoid suture.

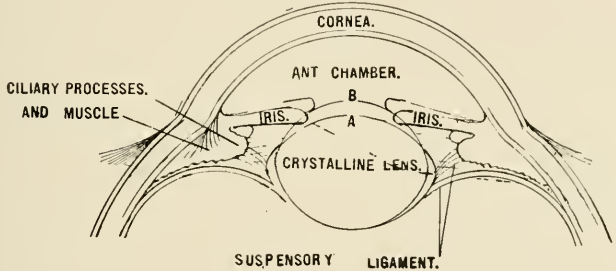
(b) The **SUPRATROCHLEAR NERVE** is the smaller and passes inward above the pulley of the Superior oblique and sends a branch to join the infratrochlear branch of the nasal. It leaves the orbit between the supraorbital foramen and the pulley and passes upward under cover of the Corrugator supercilii and Occipito-frontalis to supply the skin of the lower part of the forehead near the midline.

The **LACHRYMAL** is the smallest branch. It passes to the under surface of the lachrymal gland where it joins the orbital of the superior maxillary, forming a loop which sends branches into the gland. It passes through the sphenoid-

al fissure external and below the frontal nerve and passes along the upper border of the External rectus muscle. It then pierces the palpebral fascia and supplies the conjunctiva and integument at the outer canthus of the eye and that over the external angular process.

The **nasal branch** is the third division of the ophthalmic division of the fifth. It passes into the orbit between the two divisions of the third nerve on the floor of the sphenoidal fissure. In the orbit it passes from the outer to the inner side over the optic nerve, below the Superior rectus, then it passes between the Superior oblique and Internal rectus to leave the orbit through the anterior ethmoidal foramen with the anterior ethmoidal vessels into the cranium. In the cranium it passes forward outside of the dura mater, which separates it from the Levator palpebræ to pass through the nasal slit into the nasal fossa where it divides into its three terminal branches.

PLATE CCX.



CRYSTALLINE LENS.

(a) INTERNAL OR SEPTAL BRANCH, which is distributed to the upper and front of nasal septum. (b) External branch to superior and middle turbinated bones and to the mucous membrane of the outer wall of the nose. (c) Anterior branch runs in the groove on the inner surface of the nasal bone. It pierces the wall of the nose between the nasal bone and the upper lateral cartilage and supplies the integument of the lower part of the dorsum of the nose as far as the tip.

The NASAL NERVE gives off the following collateral branches:

1. The LONG ROOT to the ciliary ganglion which runs forward on the outer side of the optic nerve to the upper and back part of the ciliary, lenticular, or ophthalmic ganglion.

2. LONG CILIARY BRANCHES, two or three in number, pass along the inner side of the optic nerve, join the short ciliary branch from the ganglion, then pierce the sclerotic coat to be distributed to the ciliary muscle, the iris, and the cornea.

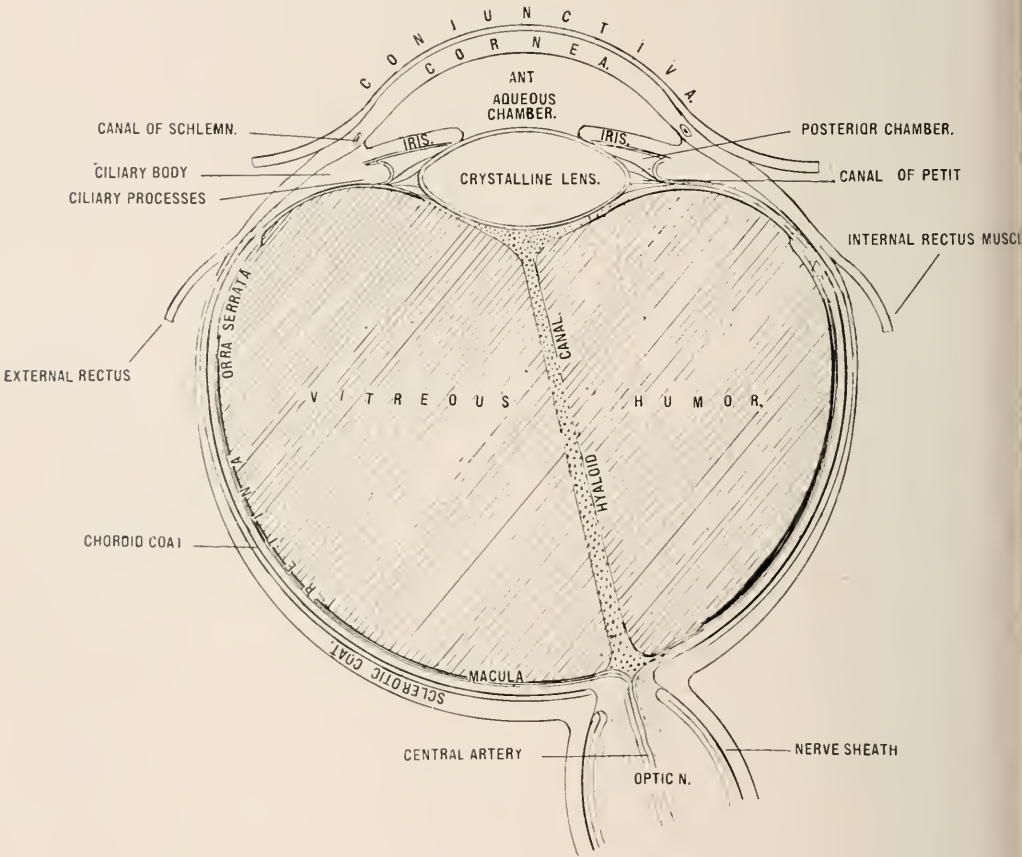
3. INFRATROCHLEAR NERVE is given off just before the nasal nerve passes between the Superior oblique and Internal rectus. It communicates with the Supratrochlear and is distributed to the skin of the eyelid and side of the nose, conjunctiva, lachrymal sac, and caruncula lachrymalis.

This **lenticular, ciliary, or ophthalmic ganglion** has three roots.

A MOTOR ROOT from the third nerve, SYMPATHETIC ROOT from the cavernous plexus, and a SENSORY ROOT from the nasal. Its branches are distributed to the iris, ciliary muscle, and cornea.

11. The **superior maxillary** division of the fifth is intermediate in size and position between the ophthalmic and inferior maxillary division. It, like the ophthalmic branch, is purely sensory. It comes from the anterior part of the Gasserian ganglion and passes through the cavernous sinus in the lower and outer part; it then leaves the cranium through the foramen rotundum, entering

PLATE CCXI.



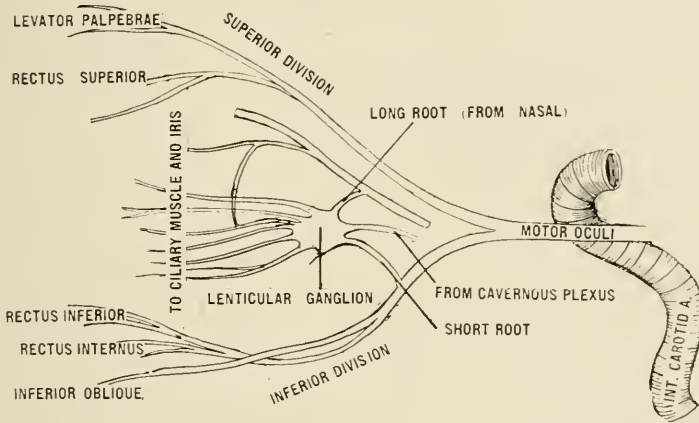
A HORIZONTAL SECTION OF THE EYE-BALL.

the speno-maxillary fossa where it is connected with Meckel's ganglion. As it passes forward it is called the infratrochlear nerve and passes in the groove on the floor of the orbit and comes out on the face through the infraorbital foramen. This foramen is beneath the Levator labii superioris and the Levator angulioris. The nerve in this position anastomoses with the seventh to form a plexus

which gives off three branches, (1) PALPEBRAL, (2) NASAL, and (3) LABIAL. While in the spheno-maxillary fossa it is in relation with the infraorbital artery which accompanies it on its course to the face. The branches of distribution are: (1) those given off in the cranium; (2) those given off in the spheno-maxillary fossa; (3) those given off in the infraorbital canal; and (4) those given off on the face.

Those in the cranium are one or two meningeal branches which unite with the recurrent branch of the inferior maxillary division of the fifth and also with the sympathetic nerve around the meningeal artery which accompanies it to the dura mater.

PLATE CCXII.



THE THIRD CRANIAL OR MOTOR OCULI NERVE.

In the spheno-maxillary fossa are, 1. Orbital or **temporo-malar** branch which passes upward and forward to enter the spheno-maxillary fissure where it divides into temporal and malar branches.

The temporal branch passes upward in a groove in the outer wall of the orbit where it receives a branch from the lachrymal before it traverses the spheno-malar foramen to enter the temporal fossa. It turns round the anterior border of the temporal fascia, then running forward and outward to pierce its fascia about an inch above the zygoma to anastomose with the seventh and auriculo-temporal of the inferior maxillary division of the fifth, and supplies the skin of the anterior part of the temporal region.

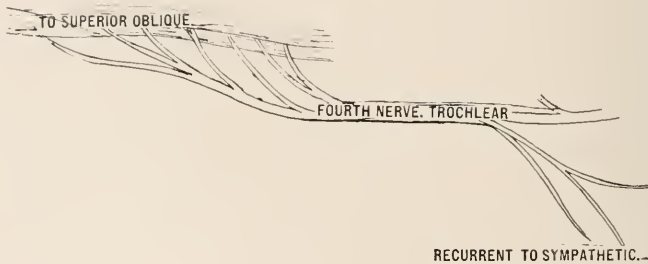
The malar branch (subcutaneous malar) supplies the skin on the prominence of the cheek after passing along the external inferior angle of the orbit through the foramen in the malar bone where it perforates the Orbicularis palpebrarum muscle.

2. The **spheno-palatine** branches are two in number and descend to the spheno-palatine or Meckel's ganglion but do not end there, for most of the fibers pass into the palatine nerves.

3. The **third set** are (1) the **POSTERIOR SUPERIOR DENTAL**, usually two in number. They pass downward and outward through the pterygo-maxillary fissure into the zygomatic fossa where they give branches to the mucous membrane of the gums and the posterior part of the mouth. They then enter the posterior dental canals on the zygomatic surface of the superior maxillary bone to communicate with the middle dental nerve and branches to the lining membrane of the antrum of Highmore (superior maxillary sinus). It also gives off three branches to the molar teeth which enter the foramina at the apices of the fangs to supply the pulp.

(b) The **MIDDLE SUPERIOR DENTAL** and the **ANTERIOR SUPERIOR DENTAL** are given off in the infraorbital sulcus. The middle supplies the bicuspid teeth and the mucous membrane of the antrum and the gums. After leaving the infraorbital nerve it passes downward and forward in a canal in the superior maxillary. These branches which supply the teeth anastomose with the anterior superior and posterior superior dental branches. At the junction of the middle and anterior is the ganglion of Boeckdalek; at the junction of the middle and posterior is the ganglion of Valentin.

PLATE CCXIII.



THE TROCHLEAR OR FOURTH CRANIAL NERVE.

LESSON CXII.

(c) The **ANTERIOR SUPERIOR BRANCH** is given off just before the infraorbital nerve enters the infraorbital foramen. It descends to supply the incisor and canine teeth. It gives branches to the gums and mucous membrane of the antrum and the nasal branch which enters the nasal fossa through a small foramen and supplies the mucous membrane of the forepart of the inferior meatus and its floor. It communicates with the nasal branch from Meckel's ganglion.

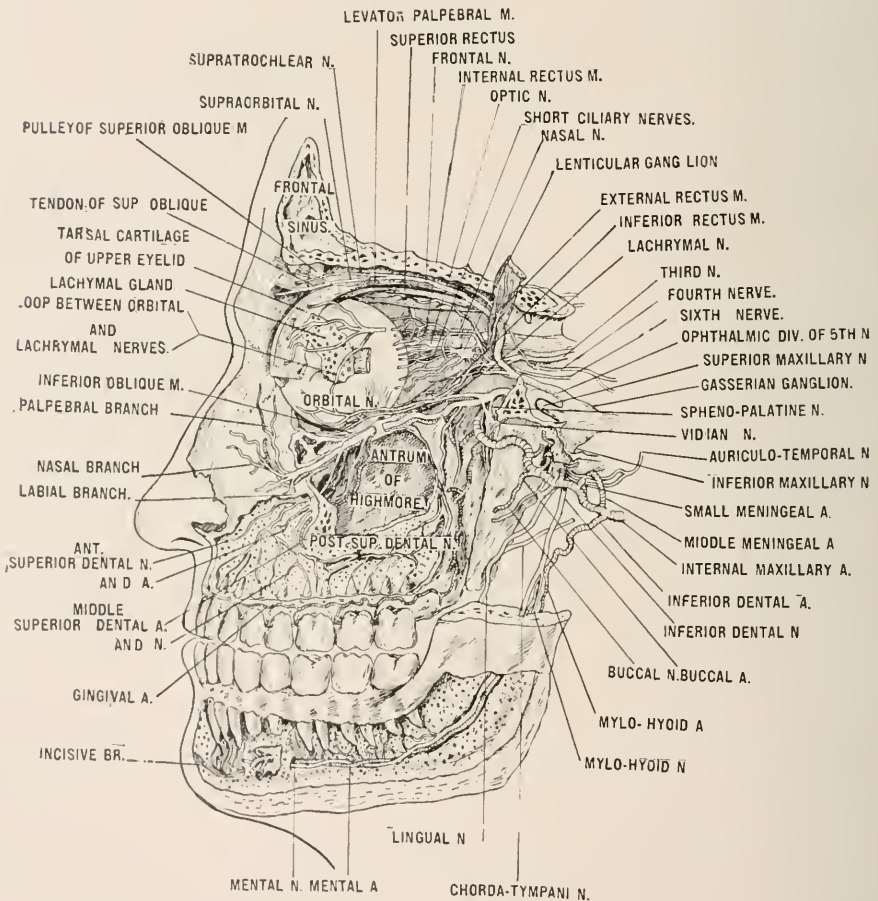
The branches on the face are **palpebral**, **labial**, and **nasal**.

The **PALPEBRAL** supplies the skin and mucous membrane of the lower eyelid. At the outer angle of the orbit it joins with the seventh and malar branch of the orbital.

and chiefly motor and gives off a masseteric branch which accompanies the masseter artery through the sigmoid notch of the inferior maxillary bone to be distributed to the Masseter muscle. It gives a twig to the temporo-mandibular articulation.

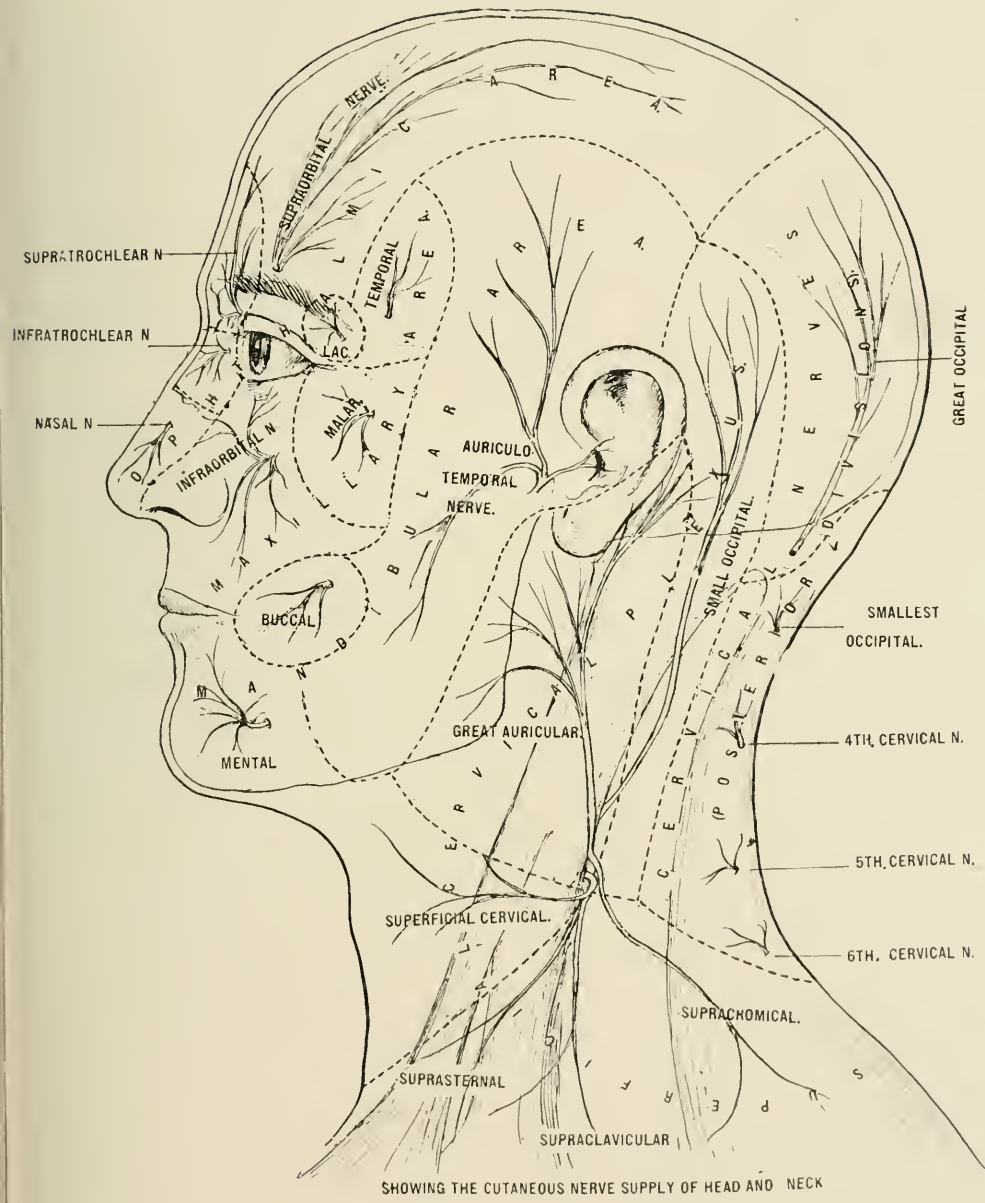
3. DEEP TEMPORAL BRANCHES, two or three in number, which lies between the bone and the upper border of the External pterygoid muscle to end in the deep surface of the Temporal muscle. The anterior one is from the Buccal to supply the front of the Temporal muscle. The middle one to supply

PLATE CCXV.



SHOWING DISTRIBUTION OF THE FIFTH NERVE IN REFERENCE TO OTHER STRUCTURES.

the deep part of the Temporal muscle after passing above the External pterygoid. The posterior one after uniting with the masseter nerve is sent to the posterior part of the Temporal muscle.



SHOWING CUTANEOUS NERVE SUPPLY OF HEAD AND NECK.

4. The **BUCCAL** is sensory and comes out between the two heads of the External pterygoid to reach the Buccinator and is often joined to the anterior temporal and external pterygoid nerves. It communicates with the seventh and is distributed to the mucous membrane of the skin of cheek.

5. **BRANCH** to the External pterygoid muscle is generally adherent to the long buccal nerve. The posterior branch of the common trunk is larger and is chiefly sensory. It has three main branches, (a) auriculo-temporal, (b) lingual which is purely sensory, but (c) the inferior dental nerve has a few motor fibers in it which pass to the Mylo-hyoid muscle.

6. The **AURICULO-TEMPORAL** arises by two heads between which is the middle meningeal artery. It then passes under the External pterygoid muscle, over the capsular ligament into the temporo-mandibular joint. From here upward with the temporal artery beneath the parotid gland to the temporal fossa where it becomes cutaneous and lies posterior to the superficial temporal artery. It gives off seven branches: (a) a branch to facial nerve, (b) a branch to the otic ganglion, (c) two anterior auricular branches distributed to tragus and upper and outer part of pinna, (d) superior temporal to integument of the greater part of the temporal region and they anastomose with the seventh, (e) auricular branch to temporo-maxillary articulation, (f) branches to external auditory meatus, which branches are given off in the parotid gland. They pass between the cartilage and the bone to enter the meatus. These branches supply the upper part of the meatus, tympanic membrane, and occasionally the lobule. (g) branches to the parotid gland.

7. **LINGUAL**(gustatory)formerly supposed to be the nerve of taste,so it was called gustatory, but it is a nerve of common sensation and the name gustatory is still used for this nerve. It lies at first internal to the External pterygoid muscle and then it passes downward in front of the inferior dental nerve and is joined at an acute angle by the chorda tympani nerve from the seventh. From here it passes downward and forward between the Internal pterygoid and the ramus, over the Superior constrictor of the pharynx on the Hyo-glossus muscle, above the deep part of the submaxillary gland to the sides of the tongue. It has (a) communicating branches to the anterior dental nerve and submaxillary ganglion and the twelfth nerve, and (b) branches of distribution to the tongue.

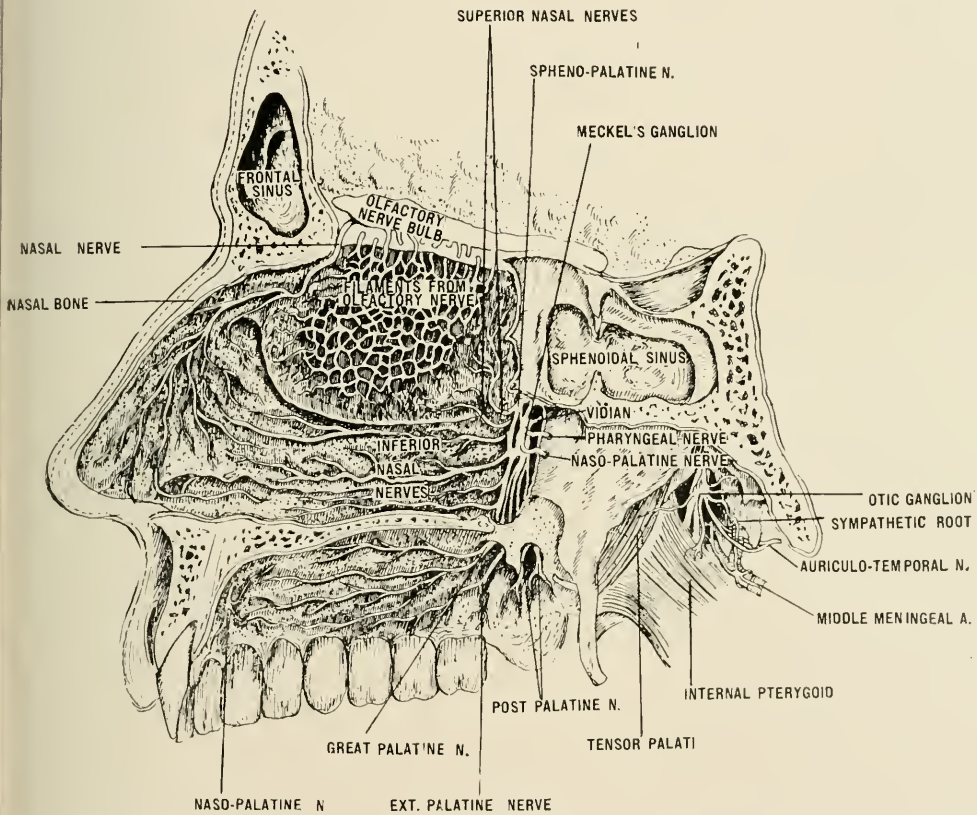
8. The **INFERIOR DENTAL** is the largest branch and passes downward under the External pterygoid muscle posterior to the lingual nerve, then to the dental foramen after passing between the ramus and internal lateral ligament. It passes through the dental canal to emerge at the mental foramen. This nerve has four main sets of branches. (a) Those to the Mylo-hyoid muscle, (b) branches to the molar and bicuspid teeth, (c) branches to mucous membrane and canine teeth, and (d) branches to the integument of chin and lower lip.

The **Gasserian ganglion** is sometimes called the semilunar ganglion. It lies in Meckel's cave near the apex of the petrous portion of the temporal bone. Beneath this ganglion is the motor root of the fifth nerve and the large superficial petrosal nerve which is a branch of the seventh. This latter nerve helps to form the vidian nerve. Filaments from the cavernous plexus of the sympathetic join this ganglion on its inner side. Branches pass to the tentorium

cerebelli and the dura mater of the middle fossa from this ganglion. The three great branches of the fifth nerve, viz., the ophthalmic, the superior maxillary, and the inferior maxillary arise from this ganglion.

Besides the Gasserian ganglion the fifth nerve has four other ganglia. (1) The **Lenticular, ciliary, or ophthalmic ganglion**, (Plate CCXIV) is about the size of a pin's head and is reddish gray in color. It is situated between the optic nerve and the External rectus muscle. The ophthalmic artery is generally on its inner side. This ganglion has three roots. (a) THE SENSORY ROOT which

PLATE CCXVII.



MECKEL'S GANGLION AND THE OTIC GANGLION.

comes from the nasal branch of the ophthalmic and joins the upper angle of the ganglion. This is the long root. (b) THE MOTOR ROOT which comes from a branch of the third nerve that passes to the Inferior oblique muscle. This is the short root and joins the inferior angle of the ganglion. (c) THE SYMPATHETIC ROOT which comes from the cavernous plexus of the sympathetic. It usually blends with the long root. This ganglion gives off five or ten short ciliary nerves from the anterior superior and the anterior inferior angles. These nerves pass with the ciliary arteries forward, one set above the optic nerve and

the other set below it. After being joined by the long ciliary nerves of the nasal branch of the fifth, they pierce the back part of the sclerotic coat of the eye and then pass forward in grooves on the inner surface of the sclerotic coat to supply the ciliary muscle, iris, and cornea. (Plate CCII).

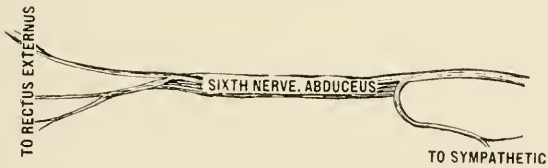
LESSON CXIII.

(2) **Meckel's ganglion** is also called sphenopalatine and is situated in the sphenomaxillary fossa. It is reddish gray in color and somewhat triangular in shape. It has three roots, (a) A **SENSORY ROOT** which comes from the superior maxillary nerve through the sphenopalatine branches. Most of the fibers of these nerves pass in front of Meckel's ganglion but a few of them enter it. (b) Its **MOTOR ROOT** comes from the facial nerve through the great superficial petrosal. (c) Its **SYMPATHETIC ROOT** comes from the great deep petrosal which is a branch of the carotid plexus. This motor root and this sensory root unite to make the vidian nerve which enters the posterior surface of the ganglion. The **great superficial petrosal nerve** comes from the geniculate ganglion of the seventh nerve in the aqueductus Fallopii. After passing through the hiatus Fallopii, it runs forward in a groove on the anterior surface of the petrous portion of the temporal bone under the dura mater and the Gasserian ganglion. In the middle lacerated foramen it unites with the **large deep petrosal** which comes from the carotid plexus and runs through the carotid canal on the outer side of the internal carotid artery. It then enters the middle lacerated foramen where with the large superficial petrosal it forms the vidian. This ganglion gives off the following branches, (a) ascending which are two or three small branches pass to the orbit through the sphenomaxillary fissure and supply its periosteum, (b) the anterior palatine, sometimes called large palatine, passes through the posterior palatine canal and the posterior palatine foramen to the hard palate where it runs forward in a groove nearly to the incisor teeth. It supplies the gums, mucous membrane, and glands, and communicates with the nasopalatine nerves. The inferior nasal branches come from the anterior palatine and pass through foramina in the palate bone and supply the middle meatus and the middle and inferior turbinated bones. The anterior palatine also gives off a palatine branch after leaving the canal which supplies the soft palate, (c) the middle or external palatine is not always present, but when it is it passes through an accessory palatine canal to supply the uvula, tonsil, and soft palate, (d) the posterior or small palatine passes through the small posterior palatine canal to supply the Levator palati, Azygos uvulae, soft palate, tonsil, and uvula. These last two branches with branches from the glosso-pharyngeal nerve form a plexus around the tonsil. This plexus is called *circulus tonsillaris*. (e) The superior nasal which are four or five branches pass through the sphenopalatine foramen where they supply the mucous membrane on the superior turbinated processes and the middle turbinated bones and also the mucous membrane of the posterior ethmoidal cells. It communicates with the anterior dental by a branch which passes to the inner surface of the anterior wall of the antrum of Highmore. (f) The nasopalatine passes forward through

the sphenopalatine foramen and then across the roof of the nose to the septum, and from here it runs downward and forward beneath the mucous membrane to the anterior palatine foramen. The nasopalatine nerve on the left side passes through the anterior of the two foramina of Scarpa, while the one on the right side passes through the posterior one. Here they supply the mucous membrane behind the teeth and join the anterior palatine nerve. (g) The pharyngeal branches, called pterygo-palatine, arise from the back of the ganglion and pass with the pterygo-palatine artery through the pterygo-palatine canal to supply the mucous membrane of the upper part of the pharynx behind the Eustachian tube. (h) The posterior superior nasal are a few small branches which pass in the sheath of the vidian nerve to supply the mucous membrane at the back part of the roof, septum, and superior meatus in the nose, and also to the mucous membrane covering the end of the Eustachian tube.

(3) The **otic ganglion**, sometimes called Arnold's, is reddish gray in color. It is small and flat and situated under the foramen ovale on the inner surface of the inferior maxillary nerve near the point where the motor and sensory branches join. This ganglion has behind it the middle meningeal artery. On its inner side the cartilaginous portion of the Eustachian tube and the origin of the Tensor palati muscle. This ganglion has three roots which are (a) its

PLATE CCXVIII.



THE ABDUCENS OR SIXTH CRANIAL NERVE.

MOTOR ROOT which comes from the internal pterygoid branch of the inferior maxillary division of the fifth, (b) ITS SENSORY ROOT may come from the same origin as the motor root, (c) ITS SYMPATHETIC ROOT comes from the sympathetic fibers from the middle meningeal plexus. (N. B.) Its motor root may come from the facial nerve, and its sensory from the glosso-pharyngeal nerve through the small superficial petrosal nerve and the tympanic plexus.

Branches from this ganglion are (a) a filament passes backward on the outer side of the Eustachian tube to the Tensor tympani muscle, (b) a branch passes to the Tensor palati muscle. Both of these branches are derived principally from the internal pterygoid nerve. (c) Small branches pass to the chorda tympani and buccal nerves.

(4) The **submaxillary ganglion** is situated above the deep portion of the submaxillary gland close to the posterior border of the Mylo-hyoid muscle. This ganglion has three roots which are (a) ITS SYMPATHETIC ROOT is from the plexus on the facial artery, (b) ITS MOTOR ROOT is from the chorda tympani of the facial and (c) ITS SENSORY ROOT is from the fifth nerve. This ganglion gives off the following branches, (a) five or six small branches which supply the

mucous membrane of the mouth and Whorton's duct and the submaxillary gland, (b) branches pass from the lingual branch through the submaxillary ganglion with the chorda tympani to the sublingual gland and tongue. Thus we see that each of these four ganglia has three roots, a motor, a sensory and a sympathetic.

LESSON CXIV. (Plate CCXIX-CCXX.)

The **superficial origin** of the seventh nerve (Plate CLXXXVII) is in the upper part of the groove between the olivary and restiform bodies of the medulla oblongata. The deep origin is in the pons under the floor of the fourth ventricle, anterior and external to that of the sixth nerve. The seventh cranial nerve and the eighth cranial nerve were formerly called the seventh and consisted of two parts, **PORTIO DURA**, which is now called the seventh, and **THE PORTIO MOLLIS**, which is now called the eighth. The **pars intermedia** arises from the medulla between the seventh and eighth cranial nerves and is connected with them at its origin. The seventh nerve or facial nerve is the motor nerve of the facial muscles of expression, of the muscles of the external ear, *Platysma myoides*, *Buccinator*, posterior belly of the *Digastric*, *Stylo-hyoid*, *Lingualis*, and *Stapedius*. This nerve passes with the eighth nerve into the internal auditory meatus where they are joined by the *pars intermedia*. From the internal auditory meatus it runs into the aqueductus Fallopii where it has an enlargement upon it called the geniculate ganglion, which is reddish in color. It now bends backward on the inner wall over the fenestra ovalis and then runs vertically downward behind the tympanum to the stylo-mastoid foramen. After it passes out of the stylo-mastoid foramen it runs forward in the parotid gland and crosses the external carotid artery. At the ramus of the jaw it divides into the temporo-facial and cervico-facial branches. These two branches with their sub-divisions form **THE PES ANSERINUS**.

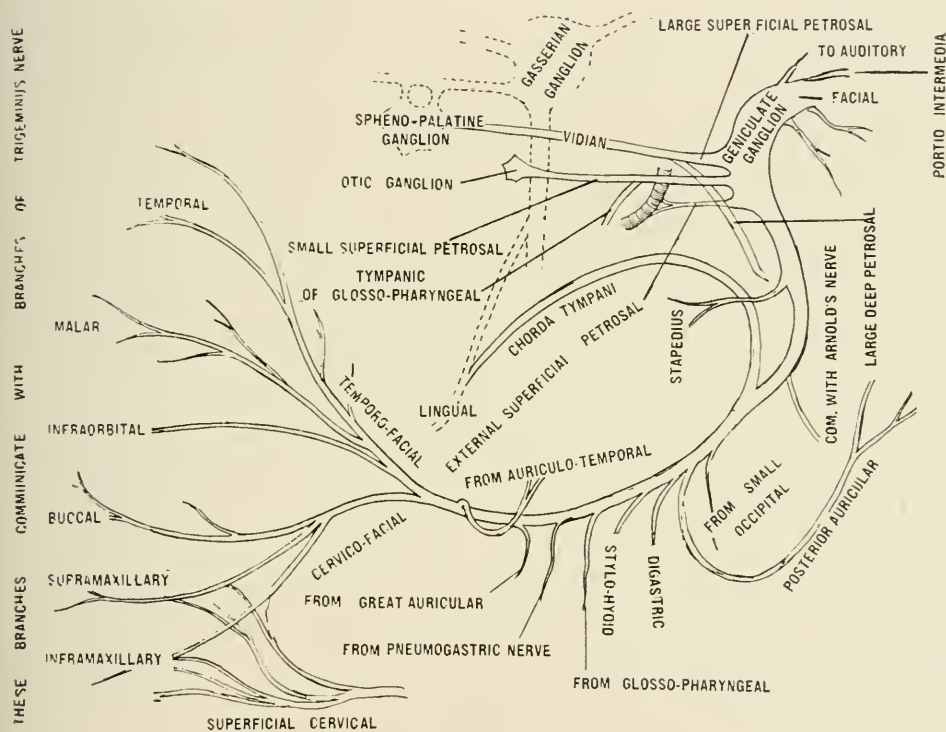
The **seventh nerve** gives off the following branches of communication, (1) **IN AUDITORY CANAL**, (a) small branches to the auditory nerve, (2) **IN AQUEDUCT OF FALLOPIUS**, (a) large superficial petrosal from the geniculate ganglion which with the large deep petrosal forms the vidian nerve. This nerve passes to Meckel's ganglion. (b) Small superficial petrosal passes from the geniculate ganglion to the otic ganglion, (c) external superficial petrosal from the geniculate ganglion to the sympathetic plexus around the middle meningeal artery, (d) a branch to the auricular branch of the pneumogastric (Arnold's). (3) **AT THE EXIT OF THE STYLO-MASTOID FORAMEN** (a) a branch to the great auricular of the cervical plexus, (b) to auriculo-temporal of the fifth, (c) a branch to the pneumogastric, (d) a branch to the glosso-pharyngeal. (4) **BEHIND THE EAR**, a branch of communication to the small occipital. (5) **ON THE FACE**, branches to the three divisions of the fifth nerve. (6) **IN THE NECK**, branches to the superficial cervical.

The **seventh nerve** has the following branches of distribution

(1) **IN THE AQUEDUCT OF FALLOPIUS**, (a) tympanic branch which arises opposite the pyramid and passes through a small canal in the pyramid to the

Stapedius, (b) chorda tympani arises a quarter of an inch above the stylo-mastoid foramen and passes upward and forward and enters the tympanum through the iter chordæ posterius on its posterior wall. This opening is between the opening of the mastoid cells and the membrana tympanum. This nerve now passes between the handle of the malleus and the vertical ramus of the incus to the anterior inferior angle of the tympanum where it passes through the iter chordæ antierius (canal of Huguier) at the inner end of the Glasserian fissure.

PLATE CCXIX.



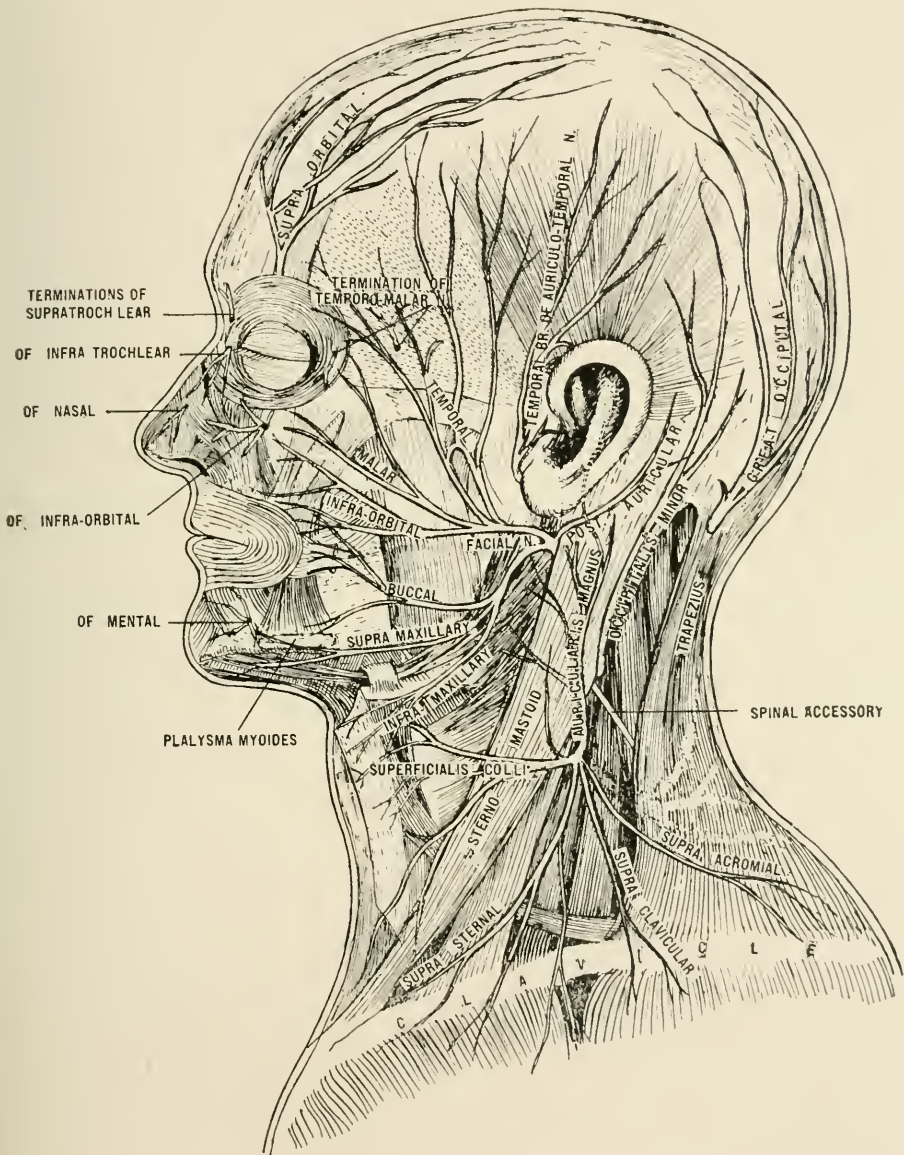
BRANCHES OF FACIAL NERVE.

While in the tympanum this nerve is covered with mucous membrane. It now passes between the Pterygoid muscles and after receiving a twig from the otic ganglion joins the lingual branch of the fifth nerve and passes with it to the submaxillary ganglion. The sublingual gland may receive a few fibers from this nerve, but most of them pass to the Inferior lingual muscle. Some physiologists claim that the chorda tympani nerve supplies the anterior two-thirds of the tongue with taste, others claim that the ninth nerve passes with this chorda tympani branch to be distributed to the anterior two-thirds of the tongue, in such a case the ninth nerve is the nerve of taste for the entire tongue.

(2) NEAR THE STYLO-MASTOID FORAMEN, (a) posterior auricular arises from the seventh nerve just outside the stylo-mastoid foramen and passes between the external auditory meatus and the mastoid process where it receives a branch of the auricular branch of the vagus. It communicates with the small occipital nerve and the mastoid branch of the great auricular. It now divides into an auricular branch which supplies the *Retrahens aurem* and an occipital branch which supplies the *Occipitalis muscels*, (b) the digastric branch may have its origin by common trunk with the stylo-hyoid branch. It supplies the posterior belly of the Digastric and after perforating that muscle joins the glosso-pharyngeal nerve, (c) stylo-hyoid branch enters the Stylo-hyoid muscle near its center and communicates with the sympathetic plexus on the external carotid artery.

(3) ON THE FACE, (a) it has the temporo-facial branch which passes through the parotid gland over the external carotid artery and temporo-maxillary vein, and as it passes over the condyle of the lower jaw it communicates with the auriculo-temporal branch of the fifth nerve. It finally divides into three sets of branches, **first**, temporal branch which crosses the zygoma of the temporal bone and supplies the *Attrahens aurem* and *Attolens aurem* muscles and joins with the temporal branch of the temporo-malar of the fifth and the auriculo-temporal also of the fifth. It supplies the *Orbicularis palpebrarum*, *Corrugator supercilii*, and the *Frontalis* muscles, and joins the supraorbital and lachrymal branches of the ophthalmic division of the fifth; **second**, the malar branches pass to the outer portion of the orbit where a few fibers pass to the *Orbicularis palpebrarum* and join branches from the lachrymal nerve, and the others supply the lower eye lid and join the malar branch of the superior maxillary; **third**, the infraorbital passes to the parts between the mouth and the orbit and supplies the superficial facial muscles and the *Pyramidalis nasi* and joins with the infratrochlear and nasal branches of the ophthalmic at the inner angle of the orbit. Other branches pass under the *Zygomatici* and the *Levator labii superioris*, supplying both of these muscles as well as the *Levator anguli oris*. They form an infraorbital plexus with the infraorbital branch of the superior maxillary and buccal branches of the cervical facial nerves. These branches supply the *Levator labii superioris alaque nasi* and the muscles of the nose. (b) The cervical facial branch passes forward through the parotid gland across the external carotid artery and receives branches from the great auricular. It divides opposite the angle of the lower jaw into three sets of branches, first, buccal which crosses the *Masseter* muscle to supply the *Buccinator* and the *Orbicularis oris*. These buccal branches join the infraorbital branches of the temporo-facial and the buccal branches of the inferior maxillary; second, the supramaxillary (mandibular) branches pass under the *Platysma myoides* and *Depressor anguli oris* to supply the muscle of the chin and lower lip and join the mental branch of the inferior dental of the fifth; third, the inframaxillary (cervical) branches pass under the *Platysma myoides* and supply it. One branch descends vertically to join the superficial cervical of the cervical plexus.

The eighth nerve will be given with the anatomy of the ear.



SHOWING FACIAL NERVE AND SUPERFICIAL CERVICAL PLEXUS.

LESSON CXV.

The **ninth cranial nerve** called the glosso-pharyngeal passes to the tongue and the pharynx. It supplies the mucous membrane of the pharynx, tonsil, and fauces with ordinary sensation, and the tongue it supplies with a nerve of taste. This nerve is a compound nerve. ITS SUPERFICIAL ORIGIN is in the groove between the olivary and restiform bodies. (Plate CLXXXVII). ITS DEEP ORIGIN is from the lower part of the floor of the fourth ventricle from three main points, (1) from a nucleus of gray matter beneath the inferior fovea, (2) from the funiculus solitarius, (3) from the nucleus ambiguus. The **nucleus ambiguus** gives motor branches to the glosso-pharyngeal and the tenth nerves and to the bulbar part of the spinal accessory nerve. The sensory fibers of the ninth nerve are in the jugular and petrosal ganglia. Van Gehuchten says that the fasciculus solitarius is the only sensory nucleus of this nerve. The ninth nerve passes from its superficial origin outward to leave the skull through the central part of the jugular foramen. It has a sheath of dura mater of its own and is situated external to and in front of the pneumogastric and spinal accessory nerves. It descends in front of the internal carotid artery and beneath the styloid process and muscles attached to it to the lower border of the Stylo-pharyngeus muscle. The nerve now passes inward, lying upon the Stylo-pharyngeus and the Middle constrictor of the pharynx. It finally passes beneath the Hyo-glossus muscle to its destination. This nerve has two ganglia upon it. The **jugular ganglion** or superior one is in the upper part of the groove in which the nerve is placed while passing through the jugular foramen. It is quite small and may be regarded as a segmentation of the lower ganglion. The **petrous ganglion** is the inferior one and is situated in the lower border of the petrous portion of the temporal bone. It is much larger than the superior one. Fibers arise from it to connect this nerve with the tenth and the sympathetic. It sends two filaments to the pneumogastric, one of which passes to the auricular branch of the pneumogastric, and the other to the ganglion of the root of the tenth. The branch which passes to the sympathetic passes to the superior cervical ganglion, and the branch which passes to the facial nerve arises from the nerve below the petrous ganglion and joins the facial just after it leaves the stylo-mastoid foramen. (Plate CCXXII).

Its **branches of distribution** are, (1) **TYMPANIC BRANCH**, called Jacobson's nerve, comes from the petrous ganglion and passes in a small canal in the lower surface of the petrous portion of the temporal bone. The lower opening of this canal is on a ridge between the carotid canal and the jugular fossa. This nerve now passes to the tympanum and forms the tympanic plexus. This plexus gives off (a) a greater part of the small superficial petrosal, (b) a branch to the large superficial petrosal, (c) branches to the tympanic cavity, (d) branches to the carotid plexus, (e) to the Eustachian tube, (f) to fenestra ovalis, (g) to fenestra rotunda.

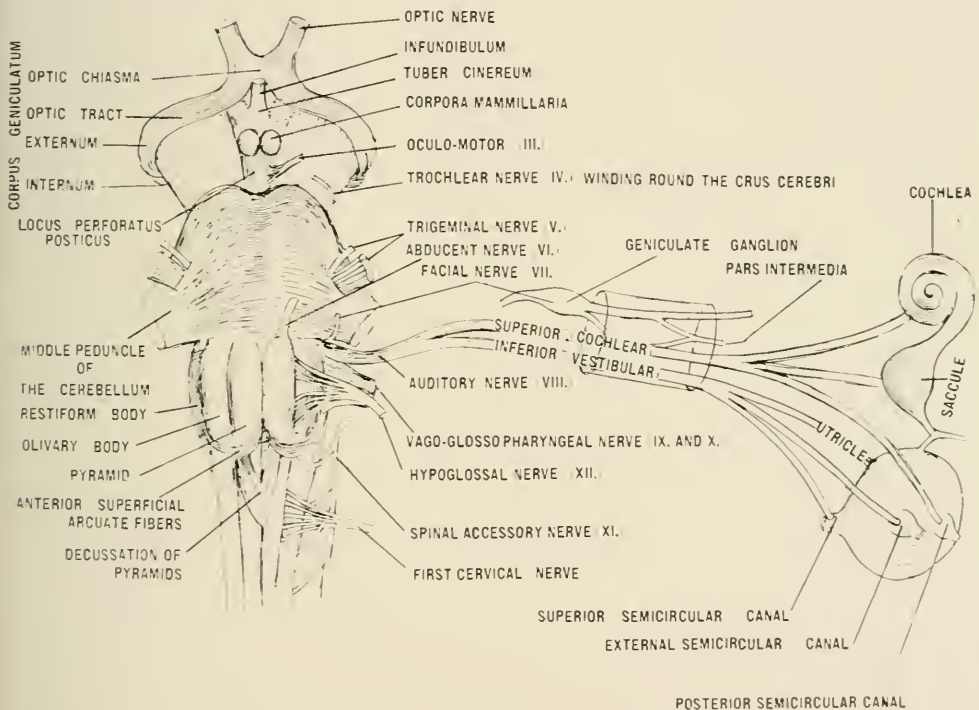
(2) **PHARYNGEAL BRANCHES** which are three or four in number unite with the pharyngeal branches of the pneumogastric and sympathetic nerves to form

the pharyngeal plexus. This union takes place opposite the Middle constrictor of the pharynx. Branches from this plexus perforate the muscular coat of the pharynx to supply the muscles and the mucous membrane.

(3) **MUSCULAR BRANCH** which is distributed to the Stylo-pharyngeus muscle, receives a communication from the seventh nerve.

(4) **THE TONSILLAR BRANCHES**, which are small, arise under cover of the Hyo-glossus muscle. They pass to the tonsil around which they form a plexus, *circulus tonsillaris*. From this plexus twigs pass to the pillars of the fauces and to the soft palate where they communicate with the palatine nerve.

PLATE CCXXI.



ORIGIN AND DISTRIBUTION OF AUDITORY NERVE.

(5) **THE LINGUAL NERVES** are two in number, one supplies the circumvallate papillæ and mucous membrane of the base of the tongue, and the other set supplies the mucous membrane and follicular glands and the posterior one-half of the tongue and communicates with the lingual nerve.

LESSON CXVI.

The **tenth cranial nerve**, pneumogastric, or vagus. Pancoast calls this nerve the auriculo-laryngo-pharyngo-œsophago-tracheo-pulmono-cardio-gastro-hepatic. This is a compound nerve and sends **motor** and **sensory fibers** to the organs of voice and respiration, and **motor fibers** to the pharynx, the œsopha-

gus, stomach, and heart. It is the longest of all the cranial nerves. Its **SUPERFICIAL ORIGIN** is from the groove between the olivary and restiform bodies below that of the glosso-pharyngeal nerve by eight or ten fasciculi (Plate CLXXXVII). Its **DEEP ORIGIN** is in the floor of the fourth ventricle from the nucleus vagi beneath the ala cinerea below and continuous with the nucleus of origin of the glosso-pharyngeal. The origin of the sensory fibers of the tenth nerve is in the ganglion of the root and the ganglion of the trunk. Van Gehuechten says that the only sensory nucleus of the tenth is in the fasciculus solitarius. The **nerve** now passes over the flocculus to the middle compartment of the jugular foramen, passing behind the glosso-pharyngeal in the same sheath with the spinal accessory. After leaving the jugular foramen it is connected with the accessory part of the spinal accessory and has an enlargement called the ganglion of the trunk. The **accessory part of the spinal accessory nerve** sends most of its branches into the pharyngeal and superior laryngeal branches of the tenth, while some of its fibers join the ganglion of the trunk. The tenth nerve now passes down the neck in the carotid sheath to the root of the neck. This sheath contains the internal jugular vein externally, the common carotid artery internally, and the tenth nerve between them but on a plane posterior. **THE RELATIONS OF THIS SHEATH ARE AS FOLLOWS:**

IN FRONT.—A few filaments descending from the loop of communication between the descendens and communicans hypoglossi.

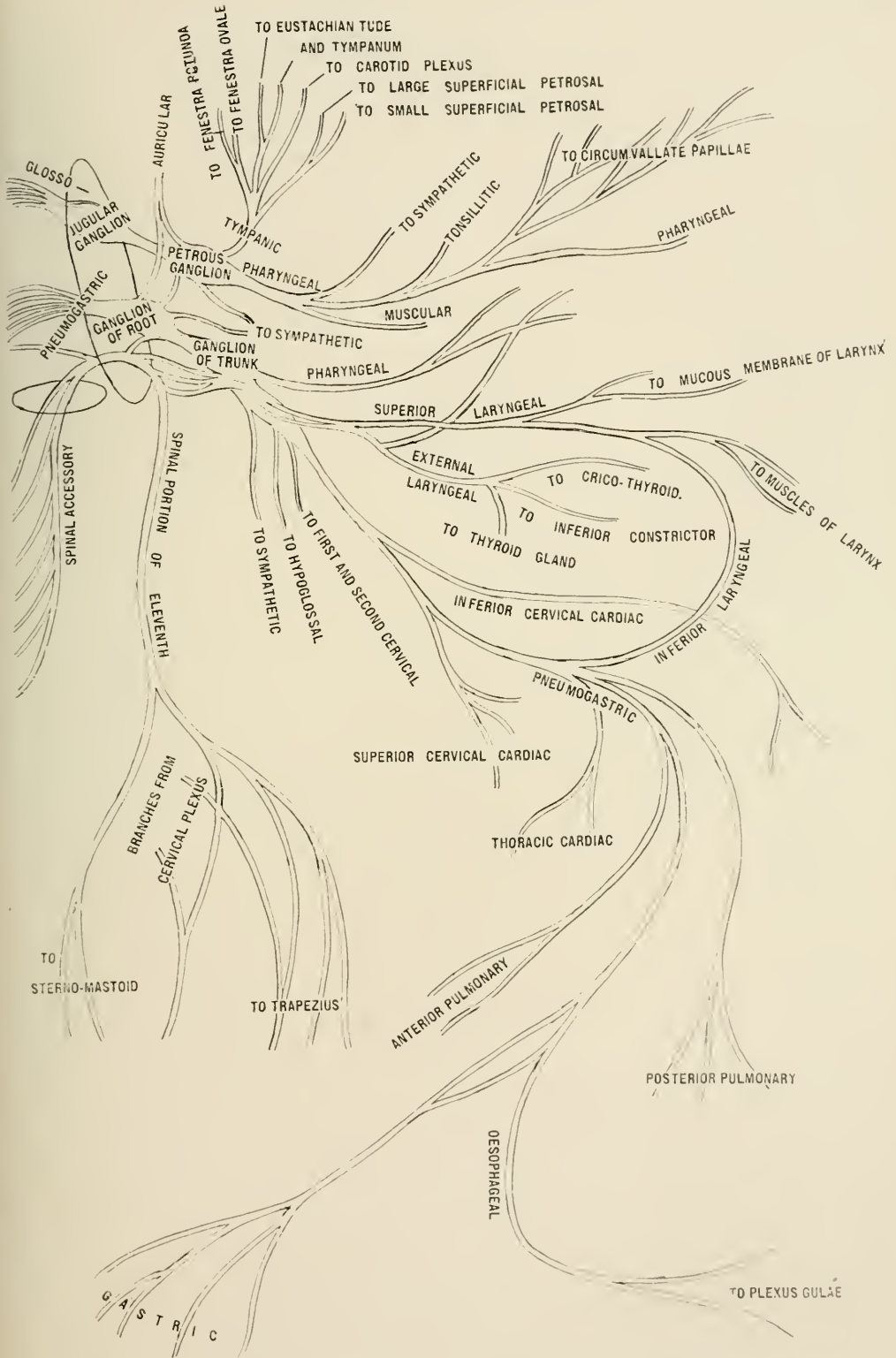
BEHIND.—(1) The inferior thyroid artery, (2) The recurrent laryngeal nerve, (3) The sympathetic nerve.

ON THE INNER SIDE.—(1) Trachea, (2) Thyroid gland, (3) Lower part of the larynx (more prominent in the female).

The **ganglion of the root** is a small gray mass about five millimetres in diameter and is situated in the jugular foramen. It is connected with the superior cervical ganglion of the sympathetic and the spinal accessory nerves. It gives off an auricular branch by which it is connected with the facial and the glosso-pharyngeal nerves. It also gives off a recurrent meningeal branch.

The **ganglion of the trunk** is below the base of the skull and in front of the internal jugular vein and is about seventeen millimetres long. It is connected with the accessory part of the spinal accessory nerve, with the hypoglossal nerve, and with the superior cervical ganglion of the sympathetic, and with the loop between the first and second cervical nerves. The branches it gives off are (1) a pharyngeal, (2) a superior laryngeal, (3) a superior cardiac. (Plates CCXXII-CCXXIII.

The **right pneumogastric nerve** passes downward between the first part of the subclavian artery and the subclavian vein beside the trachea, behind the right innominate vein, and behind the root of the right lung. It helps to form the posterior pulmonary plexus. It now passes downward in two cords which run on the œsophagus and communicate with the pneumogastric nerve of the opposite side making the œsophageal plexus. The two divisions of the pneumogastric nerve unite into one trunk behind the œsophagus and passing through the œsophageal opening in the Diaphragm, is distributed to the posterior surface of the stomach and to the solar plexus and its divisions.



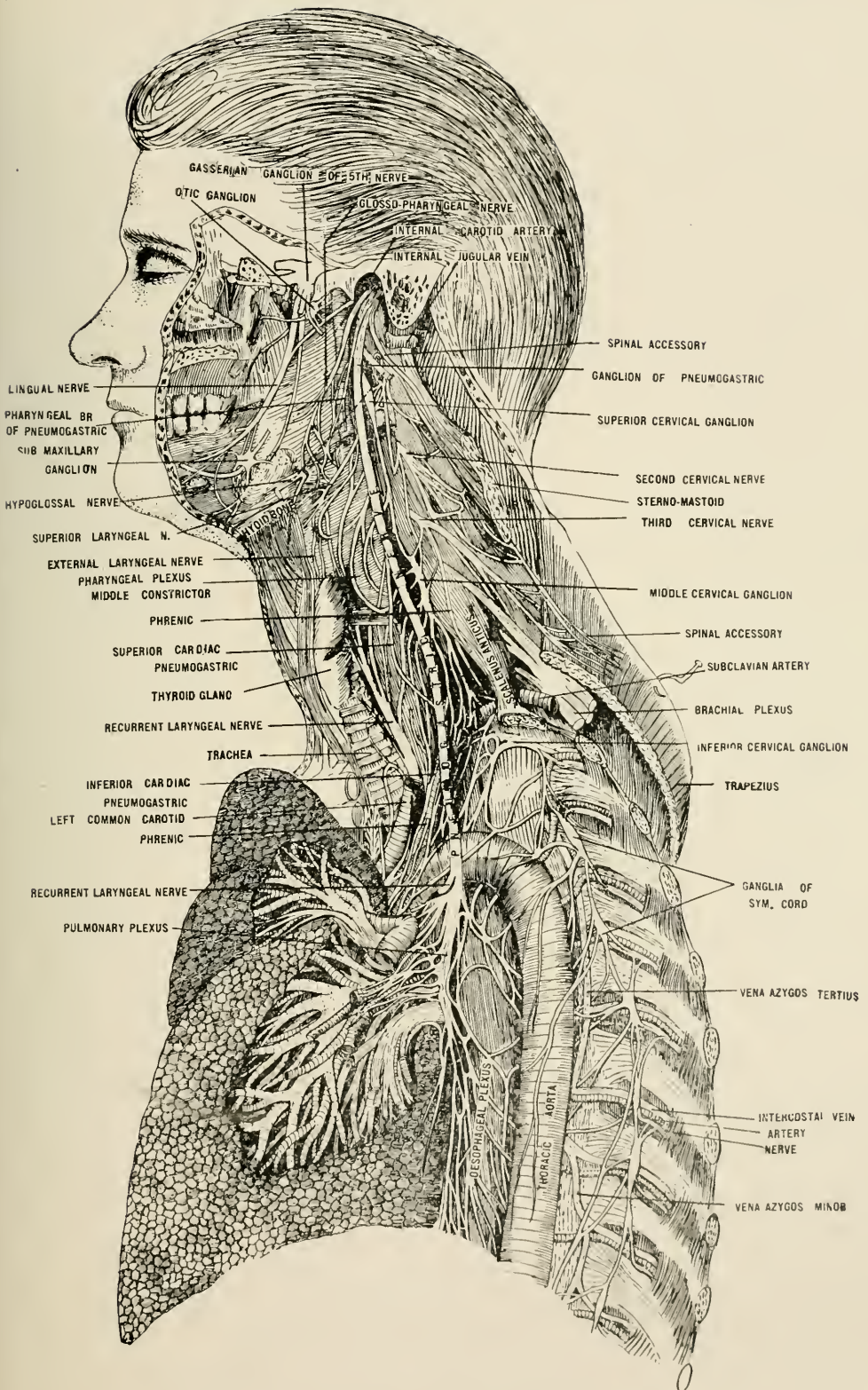
SHOWING DISTRIBUTION OF NINTH, TENTH, AND ELEVENTH CRANIAL NERVES.

The **left pneumogastric nerve** passes between the subclavian artery and the carotid artery, behind the left innominate vein. At this point the left phrenic nerve crosses it. It now passes in front of the arch of the aorta behind the root of the left lung where it helps to form the posterior pulmonary plexus. It now passes along the anterior surface of the œsophagus through the Diaphragm to be distributed to the anterior surface of the stomach and the liver. It occasionally joins the solar plexus.

The pneumogastric nerve has the following connections:

(1) THE GANGLION OF THE ROOT is joined to the spinal accessory, (2) to the petrous ganglion of the glosso-pharyngeal, (3) to the sympathetic. THE GANGLION OF THE TRUNK is joined (1) to the hypoglossal, (2) to the sympathetic, (3) to a loop between the first and second cervical nerves.

The **branches of distribution** are (1) MENINGEAL BRANCH (recurrent) which is a small filament given off from the ganglion of the root in the jugular foramen. It is distributed to the dura mater in the posterior fossa at the base of the skull. (2) THE AURICULAR BRANCH (Arnold's) comes from the ganglion of the root in the jugular foramen. A branch from the petrous ganglion of the glosso-pharyngeal joins it. The nerve now passes through a foramen in the outer wall of the jugular fossa of the petrous portion of the temporal bone and communicates with the facial nerve. It leaves the temporal bone by the stylo-mastoid foramen as a rule but it may pass through the tympano-mastoid fissure. Behind the pinna it divides into two branches one of which joins the posterior auricular of the facial, while the other supplies the posterior and inferior part of the external auditory meatus and the back of the pinna. (3) PHARYNGEAL BRANCHES are two or three and join the pharyngeal branch of the glosso-pharyngeal on the outer surface of the internal carotid artery and after passing with this artery internal to the external carotid artery, it turns downward and inward to reach the posterior aspect of the pharynx. At this point the two nerves are joined by branches from the superior cervical ganglion of the sympathetic to help form the pharyngeal plexus. This nerve is the principal motor nerve of the pharynx and comes from the upper part of the ganglion of the trunk of the pneumogastric. Most of its fibers come from the accessory portion of the spinal accessory nerve. (4) THE SUPERIOR LARYNGEAL NERVE comes from the ganglion of the trunk and passes behind the internal carotid artery where it divides into the external laryngeal nerve which branch joins the pharyngeal plexus and the sympathetic, and it supplies the Crico-thyroid muscle and Inferior constrictor muscle and occasionally the thyroid gland; and the internal laryngeal nerve which passes through the thyro-hyoid membrane to be distributed to the mucous membrane of the larynx, and it joins a branch from the recurrent laryngeal. (5) THE INFERIOR OR RECURRENT LARYNGEAL NERVE on the **right side** arises at the root of the neck in front of the first portion of the right subclavian artery. It passes around the artery and runs upward and and slightly inward behind the common carotid artery. It now runs in a groove between the common carotid artery and the œsophagus, having with it branches of the inferior thyroid artery. It passes under the lower border of the Inferior constrictor of the pharynx into the larynx where it breaks up into branches for



SHOWING PNEUMOGASTRIC NERVE AND SYMPATHETIC GANGLIA.

all the intrinsic muscles of the larynx except the Crico-thyroid muscle and communicates with the superior laryngeal. Near the beginning of this nerve it usually gives off a cardiac branch. Between the œsophagus and the trachea it gives branches to these structures and near its termination it gives some branches to the Inferior constrictor muscle. On the **left side** the recurrent laryngeal nerve comes in front of the arch of the aorta and winds round the arch external to the obliterated ductus arteriosus and passes up the left side of the trachea. The remainder of its course is similar to that of the right side. This nerve passes through the superior opening of the thorax while the right one does not. (6) THE CARDIAC BRANCHES of the pneumogastric all pass to the deep cardiac plexus except the inferior cervical cardiac on the left side. It gives off three cardiac branches, (a) the superior cervical arises from the pneumogastric from the upper part of the neck and join the corresponding branches from the sympathetic, (b) the inferior cervical cardiac nerve of the **left side** passes downward on the left side of the arch of the aorta between this arch and the pleura and joins the superficial cardiac plexus. The phrenic nerve is in front of it and the left superior cardiac of the sympathetic is behind it as it crosses the arch of the aorta. On the **right side** this branch passes in front or beside the innominate artery on the side of the trachea to join the deep cardiac plexus, (c) Thoracic cardiac branches arise near the recurrent laryngeal nerve and the one on the right side is on a higher level than the one on the left because the recurrent laryngeal nerve comes off on a higher level on the right side. They pass inward to the front of the lower end of the trachea to end in the deep cardiac plexus.

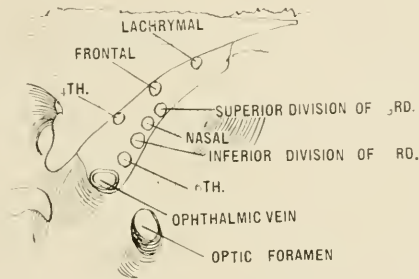
(7) THE ANTERIOR PULMONARY BRANCHES are two or three in number which arise at the upper border at the root of the lung. They join filaments from the sympathetic and form the anterior pulmonary plexus from which fine branches pass along the branches into the lung. (8) THE POSTERIOR PULMONARY BRANCHES are larger than the anterior branches and are joined by filaments from the third and fourth thoracic ganglia of the sympathetic and form the posterior pulmonary plexus from which branches pass into the root of the lung. Occasionally branches from the first and second thoracic ganglia pass to this plexus. (9) OESOPHAGEAL BRANCHES are given off from the pneumogastric both above and below the pulmonary branches, but the lower ones are larger and more numerous than the upper ones. These œsophageal branches, with the corresponding branches of the opposite side, form the œsophageal plexus (Culpe plexus). (10) THE GASTRIC BRANCHES pass through the œsophageal opening in the Diaphragm and the left one is distributed to the anterior surface of the stomach. Some of the largest branches accompany the gastric artery along the lesser curvature of the stomach, and from these small twigs pass on the hepatic artery and join the hepatic plexus. The terminal branches of the right pneumogastric are distributed on the posterior surface of the stomach and join the celiac plexus, splenic plexus, and the left renal plexus.

LESSON CXVII.

The **eleventh cranial nerve** (Plate CLXXXVII) is called the spinal accessory and is purely motor. It consists of two main parts, (1) AN ACCESSORY OR MEDULLARY PORTION, and (2) A SPINAL PORTION. THE SUPERFICIAL ORIGIN

of this nerve is by four or five small filaments from the sides of the medulla just below the superficial origin of the tenth nerve. ITS DEEP ORIGIN is in the floor of the fourth ventricle in a gray nucleus at the back of the medulla, dorso-lateral to the hypoglossal nucleus. The superficial and deep origin just given are those of the accessory portion of the nerve. THE SUPERFICIAL ORIGIN of the spinal portion is from the lateral tract of the cord as low down as the sixth cervical nerve. THE DEEP ORIGIN of the spinal portion may be traced to the medio-lateral tract of the gray matter of the cord. This **spinal portion** of the nerve passes upward between the ligamentum denticulatum and the posterior roots of the spinal nerves to enter the skull through the foramen magnum. It is then directed outward to the jugular foramen where it passes through the middle compartment of this foramen in a common sheath with the pneumogastric but separated from it by a fold of arachnoid. While in the cranium it interchanges fibers with the accessory portion. After passing out of the foramen

PLATE CCXXIV.



SHOWING STRUCTURES PASSING THROUGH THE SPHENOIDAL FISSURE.

magnum, it passes downward behind the Digastric and Stylo-hyoid muscles to the upper part of the Sterno-cleido-mastoid. It supplies the Sterno-cleido-mastoid and crosses the posterior triangle of the neck to the deep surface of the Trapezius. The **accessory portion**, while in the jugular foramen, is connected to the ganglion of the root of the pneumogastric, and some of its fibers become separated from the spinal portion and pass to the ganglion of the trunk of the pneumogastric from which they pass to the pharyngeal and superior laryngeal branches of the pneumogastric. It supplies the muscles of the soft palate through the pharyngeal branch. Some of the branches are continued below the ganglion of the trunk of the pneumogastric into the recurrent laryngeal and cardiac nerves. This is the nerve that is affected in spasmodic torticollis. (Plate CCXXII).

LESSON CXVIII.

The **twelfth cranial nerve** or hypoglossal is exclusively motor and supplies the intrinsic muscles of the tongue and the Genio-hyoid muscle and all the extrinsic muscles of the tongue except the Palato-glossus. THE SUPERFICIAL ORIGIN of this nerve arises by ten or fifteen filaments between the pyramidal and

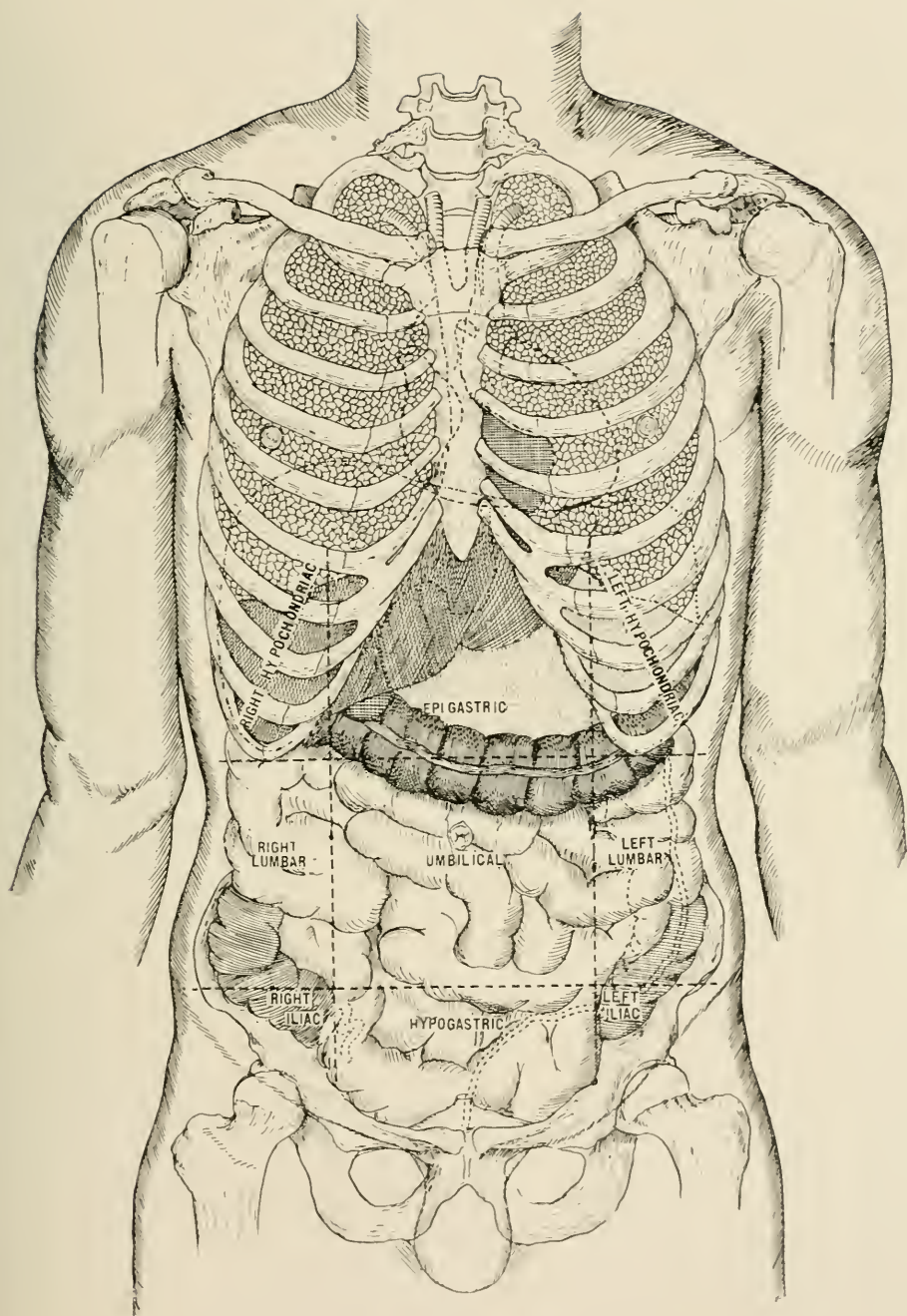
olivary bodies of the medulla. (Plate CLXXXVII). ITS DEEP ORIGIN is from the trigonum hypoglossi in the floor of the fourth ventricle. The nerve passes in two bundles through the anterior condyloid foramen after which they unite. It now passes downward between the tenth and eleventh nerves and between the internal carotid artery and the internal jugular vein to the lower border of the Digastric muscle. It now curves round the occipital artery crossing the external carotid and lingual arteries to pass between the Mylo-hyoid and Hyoglossus muscle. It now enters the Genio-hyo-glossus muscle and is continued forward to the tip of the tongue. Its **branches of communication** are (1) WITH THE GANGLION OF THE TRUNK of the pneumogastric, which connection takes place close to the exit of the nerve from the skull. It also communicates with the pharyngeal plexus as it winds around the occipital artery. (2) IT COMMUNICATES WITH THE SUPERIOR CERVICAL GANGLION of the sympathetic which communication takes place opposite the atlas. (3) IT COMMUNICATES WITH THE FIRST AND SECOND CERVICAL NERVES. (4) WITH THE LINGUAL BRANCH OF THE FIFTH which communication takes place near the anterior border of the Hyoglossus muscle. (Plate CCXXII).

Its **branches of distribution** are (1) meningeal, which are represented by two filaments given off in the anterior condyloid foramen, pass backward into the posterior fossa of the skull to be distributed to the dura mater. These nerves are probably derived from the first and second cervical nerves, the sympathetic, or the tenth. It was formerly thought they were derived from the fifth, (2) DESCENDENS HYPOGLOSSI is given off from the twelfth nerve as it passes round the occipital artery. From this point, it passes down over the sheath of the common carotid artery and joins the communicans hypoglossi from the second and third cervical nerves just above the middle of the Omohyoid muscle. This loop between the descendens hypoglossi and communicans hypoglossi is called the ansa hypoglossi. From this ansa branches are given to the Sterno-hyoid, Sterno-thyroid, and the posterior belly of the Omohyoid muscles. A filament from this loop descends into the chest to join the cardiac and phrenic nerves. (3) THE THYRO-HYOID branch passes from the twelfth nerve near the posterior border of the Hyoglossus muscle downward to supply the Thyro-hyoid muscle. (4) MUSCULAR BRANCHES are distributed to the following muscles, (a) Stylo-glossus, (b) Hyoglossus, (c) Genio-hyoid, (d) Genio-hyo-glossus, (e) to the intrinsic muscles of the tongue. Possibly the inferior lingual muscle receives the chorda tympani branch of the seventh.

SYMPATHETIC SYSTEM.

LESSON CXIX. (Plates CXCIV-CXCVI-CXCVII-CXCVIII.)

The **sympathetic nerve** differs from the somatic nerve in four different ways: (1) it has a great tendency to form plexuses; (2) it has a preponderance of non-medullated fibres; (3) fibers are interrupted in nerve cells and (4) its individual nerve fibers are smaller. The sympathetic nerve is the nerve of organic life. If we had nothing but the sympathetic nerve it would be in the form of the human body. Its frame work consists of a chain of ganglia extending in front of the vertebral column, the upper ganglia being on the anterior



SHOWING THE ABDOMINAL AREAS.

communicating artery of the circle of Willis and is called the ganglion of Ribes; the lower one, the ganglion of impar is in front of the coccyx. This frame work might be compared to a chain of beads. The thread upon which the beads are strung is called the sympathetic nerve and the beads represent the ganglia. In the **cervical region** there are only three, in the **dorsal region** eleven or twelve, in the **lumbar region** four, and in the **saeral region** five. There ought to be thirty-one of these, one for each spinal nerve, but on account of the coalescence of several into one, there are only twenty-three.

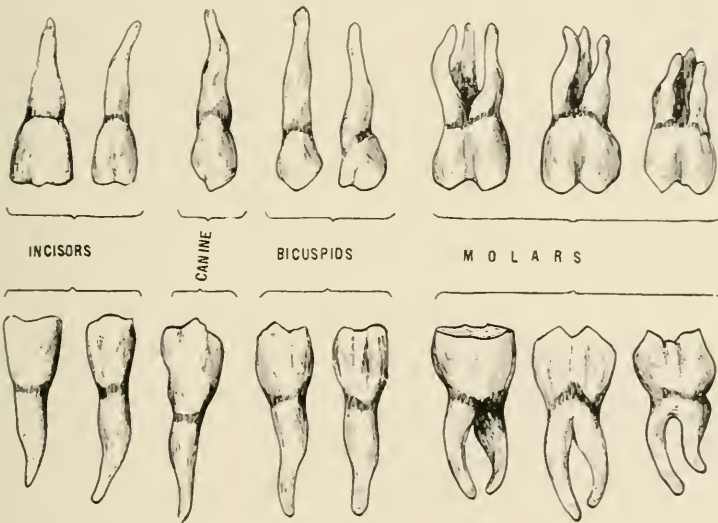
There is only one nervous system but it has three divisions: (1) the central consisting of the brain and spinal cord; (2) the twelve cranial nerves and the thirty-one spinal nerves is the peripheral system; and (3) the rest is called the sympathetic system. The frame work of the sympathetic is connected to the anterior branch of the spinal nerves by rami communicantes. Each ganglion gives off a ramus to the anterior branch of the spinal nerve which is gray, and the anterior branches of the spinal nerves in the dorsal and lumbar regions give off rami communicantes, which are **white**, to the ganglion of the sympathetic. Gray rami communicantes are indigenous to every part of the spinal cord, while the white are indigenous to the dorsal and lumbar regions. Every branch that leaves a ganglion is called a **ramus efferens**, and these rami efferentes have special names, for instance, those going to anterior branches of the first four cervical nerves are called rami communicantes and those that leave these ganglia and go to the heart are called cardiac branches. The gray rami communicantes after they pass to the anterior branch of the spinal nerves follow these nerves to their destination. Those that are given off to bone, facia, ligament, or blood vessels are called gray rami communicantes, for instance, the musculo-cutaneous nerve of the brachial plexus gives off a branch that goes into the nutrient foramen of the humerus; this is an example of the gray rami communicantes. The **anterior crural nerve** and the **obturator nerve** give off branches to the femoral artery; these branches are also examples of gray rami. The nerve to the popliteus muscle sends a branch with an artery into the tibia. This is another example of gray rami. The **parietal layer** of the peritoneum gets its nerve supply from the gray rami. Here we apply Hilton's law—the nerve which supplies the integument supplies the muscle beneath the integument and the lining beneath the muscle, and this nerve that supplies the lining does it through the branches called gray rami. The **sympathetic nerve** is developed from the ganglia upon the posterior nerve root of the spinal cord. One set of physiologists say it is developed from the suprarenal capsule. The sympathetic nerve gets to its destination by following the somatic nerves or blood vessels. The **sympathetic nervous system**, like the central system, consists of nerve cells and nerve fibres which are either motor, sensory or compound. The trophic cells are in the vertebral ganglion of the sympathetic nerve. The motor cells of the sympathetic originate in the ganglion of the sympathetic and some observers say that the sensory fibres of the sympathetic originate here also, but others say the sensory are in the cells of the spinal ganglia. In this latter case (which is probably true) reflex action can not take place within the sympathetic without involving the spinal nerves. The **super-**

for cervical ganglion is reddish-gray in color, about an inch and a half long, situated behind the internal jugular vein and the carotid artery and in front of the Rectus capitis anticus major muscle. It is in front of the transverse process of the second and third cervical vertebræ, sometimes a little higher and sometimes a little lower, and the branches given off from this superior cervical ganglion are rami efferentes.

LESSON CXX.

1. FOUR GRAY RAMI to the first four spinal nerves.
2. BRANCHES to the twelfth cranial nerve and branch to the trunk of the pneumogastric and nervus jugularis which divides, sending one branch to the root of the pneumogastric and another to the petrosal ganglion of the ninth.

PLATE CCXXVI.



THE PERMANENT TEETH.

3. FOUR OR FIVE PHARYNGEAL BRANCHES which unite with the ninth and tenth cranial nerves making the pharyngeal plexus, and other branches to the superior and external laryngeal nerves.

4. SUPERIOR CERVICAL CARDIAC NERVE which is behind the carotid sheath, behind or in front of the inferior thyroid artery, in front of the Longus colli where it joins the cardiac branches of the tenth and middle cervical cardiac branches of the sympathetic and recurrent and external laryngeal nerves. It descends behind or in front of the right subclavian artery, along the innominate artery to the division of the trachea to enter the deep cardiac plexus. The left one is in front of the left common carotid and the arch of the aorta, joining the superficial cardiac plexus.

5. THE NERVI MOLLES are branches to the external carotid artery and its subdivisions. They give off subdivisions (a) to the internal-carotid artery,

(b) to the thyroid gland, (c) to the submaxillary ganglion which comes from the sympathetic around the facial artery, (d) to the geniculate ganglion of the seventh and the otic ganglion of the fifth.

6. SENDS BRANCHES to ligaments and bones.

7. SENDS BRANCHES to the internal carotid artery which divides into two sets, those on its inner side are called CAVERNOUS PLEXUS, those on the other side CAROTID PLEXUS. The **cavernous plexus** sends off (a) branches to the pituitary body, (b) to the dura mater on the sphenoid bone, (c) to the mucous membrane of the sphenoidal sinus, (d) to the third nerve, and the fourth nerve, and the ophthalmic nerve, (e) to the carotid artery, (f) to the ciliary ganglion.

The **carotid plexus** gives off (a) small deep petrosal to tympanic plexus, (b) great deep petrosal to Vidian nerve, (c) to the Gasserian ganglion of the fifth nerve and (e) to the sixth nerve.

LESSON CXXI.

The **middle cervical ganglion** is often absent. It is triangular in shape and is made by the coalescence of two ganglia and it sends (a) two gray rami communicantes to the fifth and sixth spinal nerves, (b) branches to the thyroid gland along the inferior thyroid artery, (c) middle cardiac nerve which is behind or in front of the first part of the subclavian artery, joins the upper cardiac nerve, recurrent laryngeal nerve and ends in the deep cardiac plexus.

ON THE LEFT SIDE this nerve enters the thorax between the left common carotid and the left subclavian artery. It sends an ascending branch to join the superior cervical ganglion and one inferior to join the inferior cervical ganglion. It also sends a branch in front of the subclavian artery to join this ganglion called *ansa Vieussens*.

The **inferior cervical ganglion** is irregular. In front is the vertebral artery, behind a space between the transverse process of the last cervical and the first dorsal. It is very close to the first dorsal ganglia with which it sometimes unites. Its branches are;

(a) Two gray rami to the seventh and eighth cervical ganglia.

(b) Branches to the vertebral artery which join a branch from the first dorsal to make the vertebral plexus which surrounds the vertebral artery and going about it into the circle of Willis. This plexus joins the roots of the spinal nerves in the neck.

(c) To the inferior cervical cardiac which sometimes comes from the first dorsal; it joins the middle cardiac nerve and recurrent laryngeal nerve and descends on the trachea to the deep cardiac plexus. On the left side this nerve is occasionally joined to the middle cervical to form a common trunk.

LESSON CXXII.

The **thoracic ganglia** are eleven in number; the first one is called stellatum. It is situated on the neck of the first rib. The second to the ninth are situated on the heads of the ribs. The tenth and eleventh are on the vertebræ. They receive white rami communicantes from the spinal nerves and give off gray rami. Each of these ganglia give off rami efferentes which divide into external and

internal branches. The **external branches** send (1) branches to the meninges of the cord (2) to the posterior division of the spinal nerves, (3) to the anterior divisions of the spinal nerves. These last two pass to the vessels of the skin, glands of the skin, and the muscles of the hair. The internal branches divide into an upper set and a lower set. THE UPPER SET, four or five, send branches to the vertebræ and to ligaments and thoracic aorta and to the lungs. The LOWER SET give off the great splanchnic nerves. THE GREAT SPLANCHNIC nerves come from the fifth to tenth and end in the semilunar ganglion. THE LESSER SPLANCHNIC nerve passes from the ninth and tenth and ends in the renal or solar plexus. THE LEAST SPLANCHNIC comes from the last dorsal ganglion to end in the renal plexus. THE SECRETORY FIBERS to the lower limbs, VASO-CONSTRICTOR to vessels of the abdomen, PILO-MOTOR to the circular fibers of the rectum, and INHIBITORY FIBERS to the longitudinal muscles of the rectum descend from the thoracic to the lumbar region. Besides these there are afferent fibers (SPLANCHNIC SENSORY) which pass towards the posterior roots of the dorsal nerve. The **lumbar ganglia** are four, being set in front of the vertebræ. The right cord of the sympathetic is behind the inferior vena cava, the left behind the peritoneum. White rami pass to these ganglia and gray rami pass from them. The rami efferentes are first, external divisions and second, internal divisions. The external divisions send gray rami to the lumbar nerves. The internal divisions send (1) branches to the aorta, (2) hypogastric plexus, (3) to the vertebræ and ligaments, and additional VASO CONSTRICTOR FIBERS to the renal vessels and SECRETORY FIBERS to the vessels of the lower limbs and CONSTRICTOR FIBERS to the vessels of the lower limbs, PILO-MOTOR and MOTOR FIBERS for the circular and INHIBITORY FIBERS for the longitudinal muscles of the rectum, and MOTOR FIBERS to the uterus and vas deferens and round ligament, and VASO-MOTOR to the penis and MOTOR FIBERS to the circular and INHIBITORY FIBERS for the longitudinal muscles of the bladder.

LESSON CXXIII.

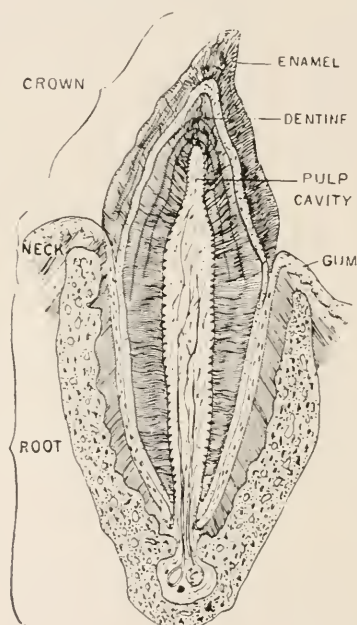
The **sacral portion** of the sympathetic ends in the ganglion of *Impar*. It has five ganglia which give off rami efferentes, (1) gray rami to the sacral nerves, (2) branches to anastomose with the branches of the opposite side, (3) branches to plexuses on the middle sacral artery, (4) branches to pelvic plexuses, (5) branches from *impar* to the coccyx and its ligament to the coccygeal gland. There are **no white rami** in this portion of the sympathetic. They descend from the dorsal region. Vaso-constrictor and secretory for the lower limbs, pilo-motor for posterior part of the body come from this region. "White rami of the sacral region" are represented by their visceral branches and are called pelvic splanchnics. They contain motor fibers to the longitudinal muscles of the bladder and for the longitudinal and inhibitory of the rectum and to the uterus and secretory to the prostate gland and vaso-dilator to the penis.

White rami enter the cervical sympathetic from the dorsal; some terminate in the superior ganglion, some in the middle ganglion, and some in the lower ganglion. The distribution of many are unknown.

The **sympathetic has three great prevertebral plexuses**. FIRST, the cardiac,

which is situated below and behind the arch of the aorta. For convenience it is divided into two parts, the superficial and deep. It is formed by all the cardiac branches and the cardiac branches of the pneumogastric nerve. The three cardiac branches come from the three cervical ganglia, the superior from the superior one, and the middle from the middle one, and the inferior one from the inferior cervical ganglion. These unite with the pneumogastric nerve and form the cardiac plexuses. The superficial cardiac plexus is made by the left superior cervical cardiac and the left inferior cervical cardiac from the pneumogastric, plus fibers from the deep plexus. The **superficial cardiac plexus** gives off branches to the right coronary plexus and the left pulmonary plexus. The **deep cardiac plexus** consists of left portion and right portion. THE LEFT POR-

PLATE CCXXVII.



A VERTICLE SECTION OF A CANINE TOOTH.

TION gives off branches to the left coronary plexus and the left auricle. THE RIGHT PART gives off branches both to the right and left pulmonary plexuses and the right auricle.

Thus we see that the cardiac plexus is made by sympathetic nerves plus somatic nerve, and the somatic nerve is the tenth.

LESSON CXXIV.

The **solar plexus** has three names, SOLAR, EPIGASTRIC, ABDOMINAL BRAIN. It is situated around the coeliac axis. It is formed by the three splanchnic nerves from each side and the semilunar ganglia and the right pneumogastric nerve, and occasionally the left. It gives off branches to the following arteries and these subdivisions take the names of the arteries which they surround.

This plexus, like the cardiac plexus, is made up of sympathetic nerves plus somatic nerve, which is the tenth cranial.

PHRENIC OR DIAPHRAGMATIC PLEXUS.

This plexus accompanies the phrenic artery and is larger on the right than on the left side. At its point of junction with the phrenic nerve is the Ganglion diaphragmaticum. This plexus is situated on the under surface of the Diaphragm near the supra renal capsule. Its branches are distributed to (1) Inferior vena cava, (2) supra renal capsule, and (3) hepatic plexus. There is no ganglion on the left side. It receives branches from the semilunar ganglia and solar plexus, also from the phrenic nerve. This plexus gives off branches to the Diaphragm and the supra renal capsules.

SUPRA RENAL PLEXUS.

This plexus surrounds the supra renal artery and its branches are of large size. At its junction with the great splanchnic nerve is found a ganglion. It receives branches from the solar plexus and semilunar ganglia, also from the phrenic nerve and the diaphragmatic plexus. It distributes branches to the medullary portion of the suprarenal capsules.

RENAL PLEXUS.

This plexus surrounds the renal artery and contains groups of ganglion cells. Its branches of distribution enter the hilum of the kidney. This plexus receives branches from the solar plexus and semilunar ganglia, also from the aortic plexus and smallest splanchnic nerves. It sends branches of distribution to the substance of the kidney, the spermatic plexus and the inferior vena cava.

SPERMATIC PLEXUS.

This plexus accompanies the spermatic vessels to the testes. It receives branches from the renal, aortic, and pelvic plexus. It distributes branches to the spermatic vessels, vas deferens, and the testes.

In the female this plexus follows the course of the round ligament to the ovarian plexus and is distributed to the ovaries and fundus of the uterus.

CELIAC PLEXUS.

This plexus is a direct continuation of the solar plexus and surrounds the celiac axis. It receives branches from the solar plexus, the lesser splanchnic nerves, and the right vagus. It sub-divides into the (1) gastric plexus, (2) hepatic plexus, (3) splenic plexus.

The **gastric plexus** accompanies the gastric artery along the lesser curvature of the stomach. It receives branches from the celiac plexus and from the left vagus nerve. It sends branches of distribution to the stomach and to the pyloric plexus.

The **hepatic plexus** is the largest offset from the celiac plexus. It receives branches from the celiac plexus, the left vagus nerve and the right phrenic nerve. It distributes branches to the pyloric plexus, and branches to the gastroduodenal plexus, which plexus divides into the right gastro-epiploic plexus and the pancreatico-duodenal plexus. It also sends branches to the cystic plexus, the right hepatic and the left hepatic plexus.

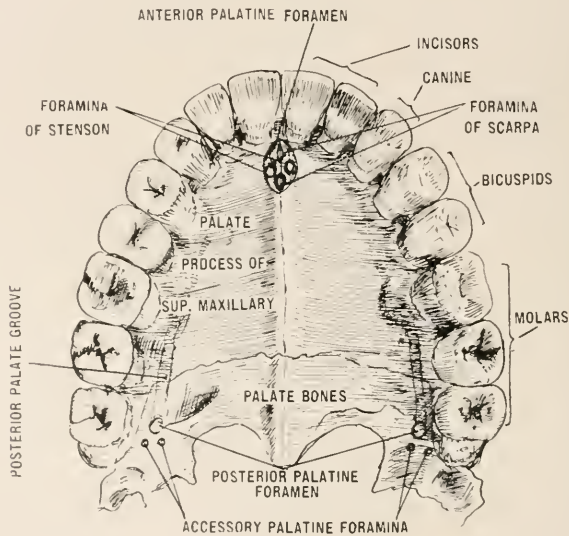
The **splenic plexus** accompanies the splenic artery, and receives branches

from the cœliac plexus, the right vagus nerve, and the left semilunar ganglion. It distributes branches to the pancreatic and left gastro-epiploic plexus, also to the substance of the spleen.

SUPERIOR MESENTERIC PLEXUS.

This plexus emerges from under cover of the pancreas and surrounds the trunk of the superior mesenteric artery. A few ganglia which are found around this artery are called ganglia mesenterica. The branches of this plexus are of a large size and are white and firm. It receives branches from the solar plexus, the cœliac plexus, and the right vagus nerve. It gives off branches to the pancreas, all the small intestines, to the ascending and half of the transverse colon, and to the pancreatico-duodenal plexus.

PLATE CCXXVIII.



THE HARD PALATE.

Branches from this plexus form a secondary plexus corresponding to the primary and secondary loops of the artery and reach the small intestines by spreading out in the mesentery.

AORTIC PLEXUS.

This plexus is situated on the sides and in front of the aorta, between the origins of the superior and inferior mesenteric arteries.

It receives branches from the solar plexus and semilunar ganglia, also from the lumbar ganglia. It gives off branches of distribution to the spermatic plexus, the inferior mesenteric plexus, the hypogastric plexus, and the inferior vena cava.

INFERIOR MESENTERIC PLEXUS.

The inferior Mesenteric plexus surrounds the inferior mesenteric artery and divides into a number of secondary plexuses. Upon this artery is a ganglion called the inferior mesenteric ganglion. This plexus receives branches

from the aortic plexus. It distributes branches to half of the transverse colon and the descending colon, to the sigmoid plexus, to the superior hemorrhoidal plexus, and to the pelvic plexus.

LESSON CXXV.

HYPOGASTRIC PLEXUS.

This plexus is situated in front of the promontory of the sacrum between the common iliac arteries. It contains no ganglia. It receives branches from the aortic plexus, the lumbar ganglia. It bifurcates below into two lateral halves which form the pelvic plexuses. This plexus is made up exclusively of sympathetic nerves.

PELVIC PLEXUS.

This is situated at the side of the rectum and bladder in the male, and in the female it is at the side of the rectum, bladder and vagina. It accompanies the branches of the internal iliac artery and supplies the pelvic viscera. This plexus contains small ganglia. It is formed by the two lateral continuations of hypogastric plexus, branches of the sacral part of the gangliated cord, branches of the second, third and fourth sacral nerves. It sends branches of distribution to the middle hæmorrhoidal plexus, the inferior hæmorrhoidal plexus, the vesical plexus, the prostatic plexus, the vaginal plexus, and the uterine plexus.

The middle hæmorrhoidal plexus is situated on the sides of the rectum, and is formed by branches from the pelvic plexus. It communicates above with the superior hæmorrhoidal plexus and below with the inferior hæmorrhoidal plexus. It is distributed to the rectum.

The inferior hæmorrhoidal plexus arises from the back part of the pelvic plexus and joins with branches from the superior and middle hæmorrhoidal plexuses. It is distributed to the rectum.

The vesical plexus arises from the fore part of the pelvic plexus, and is formed chiefly by fibers from the third and fourth sacral nerves. The nerves sent off pass on each side of the bladder. This plexus is divided into two groups, (1) superior group, (2) inferior group. It distributes branches to the bladder, the vesiculæ seminales, the vas deferens, the spermatic plexus.

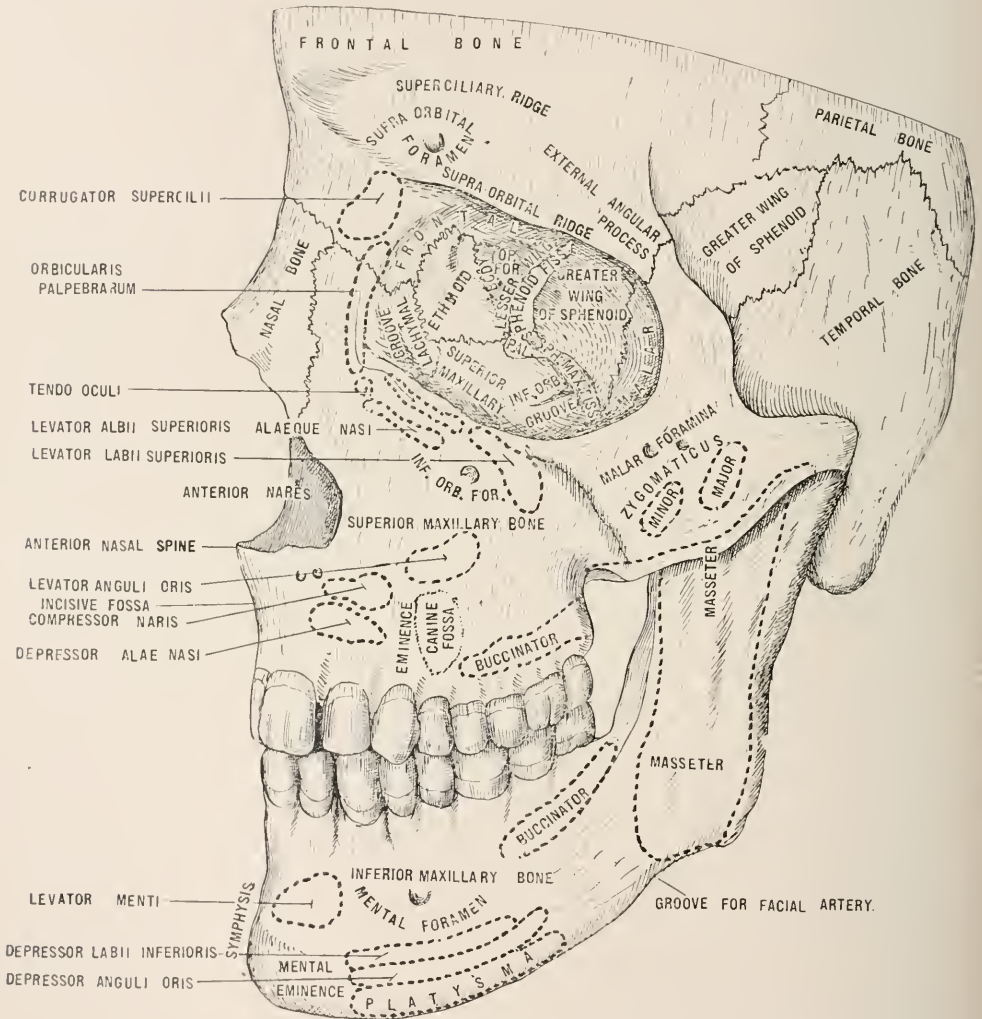
The prostatic plexus is a continuation downward of the pelvic plexus and is situated around the prostate gland. Its nerves are of large size. On the sides of the gland are several ganglionic masses from one-fourth to one-half an inch in length (ganglia prostatica of Muller). It is joined by branches of the internal pudic nerve. It distributes branches to the prostate gland, the vesiculæ seminales, small cavernous nerves to the erectile structure of the penis, corpora cavernosa and corpus spongiosum. Large cavernous nerve joins the dorsal branch of the pudic nerve and supplies the corpora cavernosa and corpus spongiosum.

The vaginal plexus arises from the lower part of the pelvic plexus and is composed largely of sacral nerves. It is situated on the sides of the vagina. It gives off branches to the erectile tissue of the vagina, the mucous membrane of the vagina, and a few twigs to the clitoris.

The uterine plexus arises from the upper part of the pelvic plexus and ac-

companies the uterine artery between the layers of the broad ligament. It receives a few twigs from the ovarian plexus. It distributes branches to the cervix and body of the uterus. Other filaments pass separately into the body of the uterus and the Fallopian tubes. There are ganglionic enlargements found on these filaments.

PLATE CCXXIX.



THE BONES OF THE ORBIT.

LESSON CXXVI.

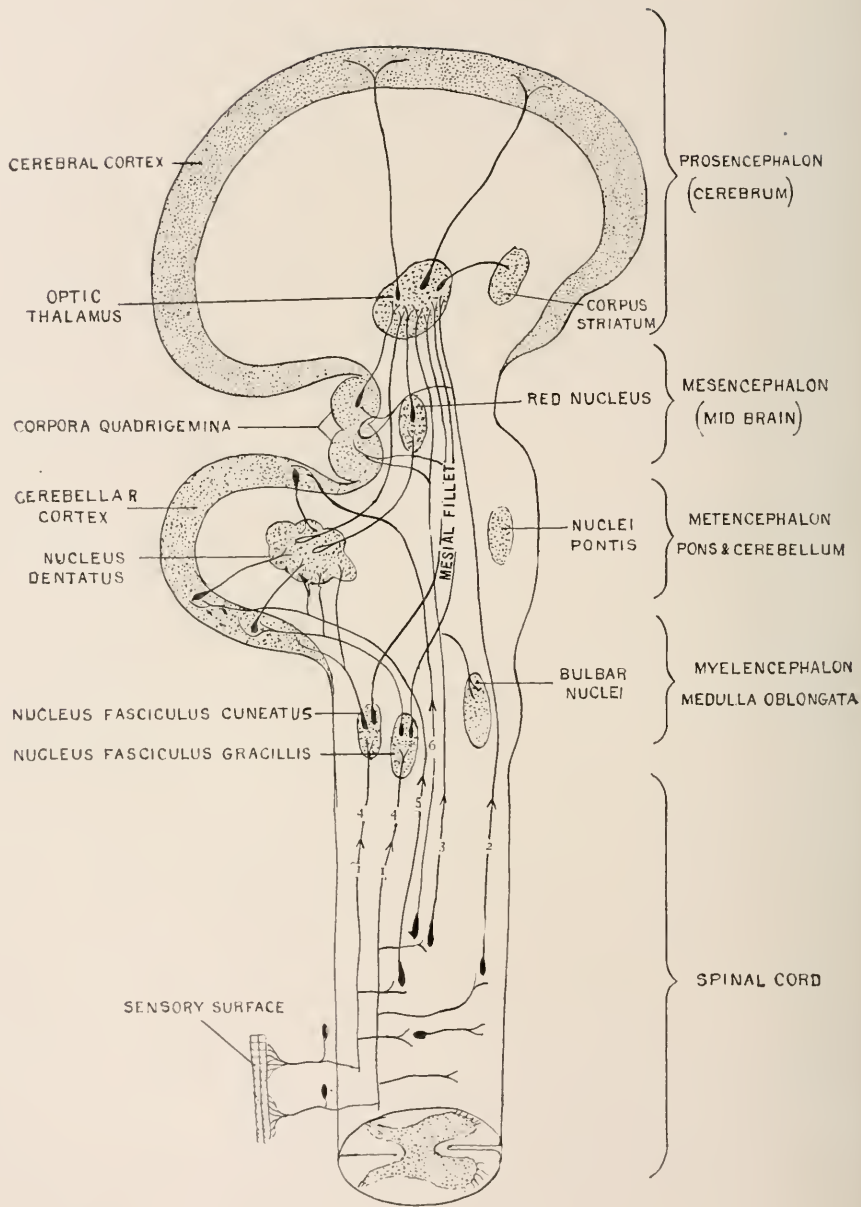
The gray rami communicantes originate in cells of the vertebral ganglion, and from here pass to their destination by way of the spinal nerves, (1) to adjacent ganglia, (2) to the prevertebral plexus, (3) directly to the viscera and vessels. Their trophic cells are in these ganglia where they originate. These

nerves are indigenous in every part of the spinal cord. The branches that pass to the femoral artery from the Anterior Crural and Obturator are gray rami communicantes, and through these branches the non-medullated axis-cylinder processes of the sympathetic ganglion cells reach the vessels, fasciæ, bones, cartilages, and periosteum of the lower extremity.

A **gray ramus communicans** passes to the tibia from the branch of the internal popliteal nerve which passes to the Popliteus muscle. Each spinal nerve is joined near its origin by a gray ramus communicans from the sympathetic gangliated cord. The superior cervical ganglion gives off four gray rami communicantes to the first four cervical nerves. These rami may come from the sympathetic nerve below the ganglion. The middle cervical ganglion sends two gray rami to the fifth and sixth cervical nerves. The inferior cervical ganglion sends two gray rami to the seventh and eighth nerves. The first dorsal ganglion (stellatum) of the sympathetic or the last cervical sends a gray ramus to the first dorsal nerve. One ganglion may send gray rami to two nerves, or two gray rami to one nerve. In the lumbar and sacral regions the gray rami are long and pass downward and outwards over the bodies of the vertebrae to reach the anterior division of the nerve. In the lumbar region they pass under the Psoas magnus muscle.

The **white rami communicantes** originate in the motor roots of the cranial and spinal nerves. Some of these white rami pass through the vertebral ganglia without interruption, while others arborize with cells in the vertebral ganglia. The white rami communicantes are indigenous in the thoracic and upper lumbar regions only, while the gray rami are indigenous in all parts of the cord. The white rami may be called the visceral divisions of the spinal nerves. Although the white rami are for the most part derived from the ventral or anterior roots, yet some of them come from the dorsal or posterior roots. The white rami from the first two lumbar, and perhaps also from the third and fourth lumbar nerves, pass forward by themselves or in company with the gray rami to join the upper part of the lumbar gangliated cord. The fifth lumbar and first sacral do not have white rami while the third sacral and possibly the second and fourth have both white and gray rami. The fifth sacral and coccygeal nerves have no white rami.

In Plate CXCVIII we see the **gray and white rami communicantes**. A, B, C, and D represent white or medullated rami, while E, F, G, H, L, M, N, represent the gray or non-medullated rami. A passes from the anterior or ventral root to the sympathetic ganglion of its own segment through which it passes to the ganglion below. B has a similar origin but ends in the ganglion of its own segment. C has a similar origin and passes through the sympathetic ganglion of its own segment to a prevertebral plexus or directly to viscera. D has a similar origin and passes through the sympathetic ganglion of its own segment to end in a higher ganglion. E originates in the sympathetic ganglion and passes along the posterior nerve root to the dura mater of the cord. G originates in the sympathetic ganglion and passes along the posterior division of the spinal nerve to its destination. H originates in the sympathetic ganglion and passes along the anterior division of the spinal nerve to its destination. It passes to



SHOWING THE SENSORY PATHWAYS TO THE BRAIN.

somatic, vaso-motor, pilo motor, and secretory. K originates in the sympathetic ganglion and passes along the recurrent branch to the vertebræ, ligaments, spinal vessels, and dura mater of the cord. L originates in the sympathetic ganglion and passes along the gray rami for a short distance then it leaves it to pass to the vertebræ, intercostal and lumbar vessels. M originates in the sympathetic ganglion and like all others that originate in this ganglion are called rami efferentes. N originates in the sympathetic ganglion and pass to the ganglion above it or the ganglion below it.

LESSON CXXVII.

"The **gross anatomy** of the cervical sympathetic gives no idea of its true anatomical relations as revealed by physiological experiments and pathological phenomena. The physiological connections as at present understood may be summed up as follows:

1. PUPILLO-DILATOR FIBERS pass by white rami communicantes from the first, second and third thoracic nerves and ascend in the sympathetic cord to the superior cervical ganglion to form arborizations round its cells. Thence gray fibers pass to the Gasserian ganglion and reach the eye-ball by the ophthalmic division of the fifth and long ciliary nerves.

2. MOTOR FIBERS to the involuntary muscles of the orbit and eyelids from the fourth and fifth thoracic nerves follow a similar course.

3. VASO-MOTOR-FIBERS to the head, secretory fibers to the submaxillary gland, pilomotor fibres to the head and neck are derived from the upper thoracic nerves and reach their areas of distribution after a similar interruption in the superior cervical ganglion.

4. THE ACCELERATOR FIBERS of the heart are derived from the upper thoracic spinal nerves, and end similarly in the middle and lower cervical ganglion gray fibers in the cervical cardiac nerves completing the connection."—(Gerrish).

"A patient with laceration of the cervix goes through five stages: (1) IRRITATION; (2) INDIGESTION; (3) MALNUTRITION; (4) ANEMIA; (5) NEUROSIS.

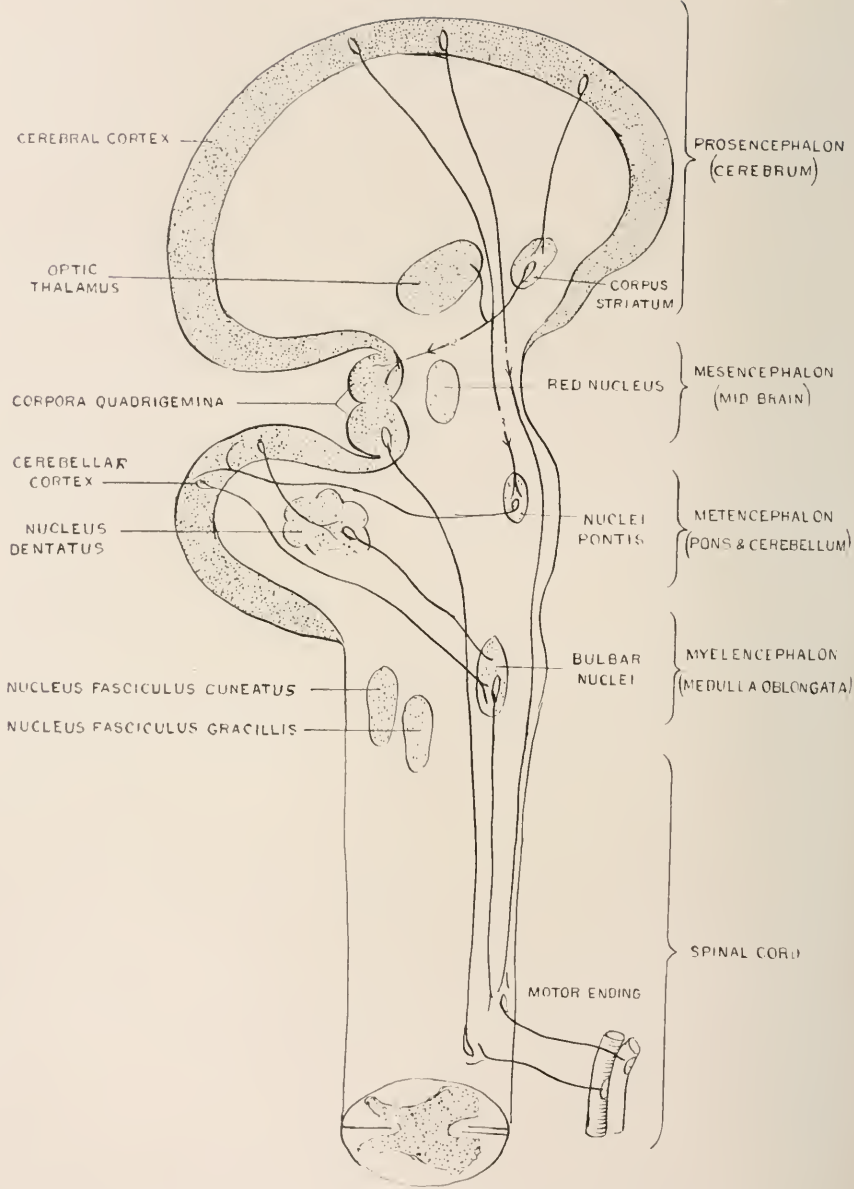
These stages will appear if the patient has a neuropathic constitution or diathesis.

"A general summary of the abdominal brain is: that (a) it presides over nutrition; (b) it controls circulation; (c) it controls gland secretion; (d) it presides over the organs of generation; (e) it influences in a dominant, though not an absolute, control its peripheral visceral automatic ganglia."—(Byron Robinson).

LESSON CXXVIII.

CONDUCTING PATHS. (Plates CCXXX-CCXXXI-CCXXXIII).

The **cortex** of each hemisphere of the brain is in communication with the opposite half of the body by means of fibers conducting impulses to and from it. These fibers maybe divided into two sets, according to the direction of conduction; **centrifugal**, or **motor**, which conduct excitations from the cortex to the various muscles of the body; and **centripetal**, or **sensory**, which convey excita-



SHOWING THE MOTOR PATHWAYS FROM THE BRAIN.

tions from the skin, mucous membranes, bones, special sense organs, to the cortex, where are produced in an unknown way what we call sensation. Each half of the body is thus represented in or projected upon the cortex of the opposite hemisphere; hence the name of projection fibers given to those fibers of the brain through which communication is maintained. (Plate CLXXXI). They are in many instances collected into distinct bundles; so that we may speak of motor and sensory tracts or paths, meaning thereby definite groups of fibers along which motor or sensory impulses, as the case may be, travel. Moreover these groups of fibers often arise from or terminate in fairly definite areas of the cortex, which areas are usually called **centers**. (Plate CLXXXIII). Thus, that from which springs the fibers that conduct impulses to the muscles which produce the movements of the hand may be called the motor center of the hand; that which receives the fibers along which visual impressions travel is the center of sight.

Of the many ways in which impulses may travel between the brain and the spinal cord, the following (1), (2), (3), (4), (5), (6), are the most important that have been demonstrated. If these impulses travel through the cerebellum we call the way they pass **the indirect route**, but if they miss the cerebellum we call the way they travel **the direct route**. This applies to both motor and sensory impulses.

Sensory impulses, which are afferent, (centripetal) take the following routes:

(1.) **THEY TRAVEL BY THE WAY OF THE TRACTS OF GOLL AND BURDACH** (fasciculus gracilis et cuneatus) (Plate CCXXX) to the nuclei gracilis et cuneatus by means of neurones of the first order. By way of explanation we might say that a **neurone system** consists of a group of nerve fibers and their cells of origin. From nuclei gracilis et cuneatus the impulses travel by neurones of the second order through the mesial fillet to the optic thalamus. The mesial fillet crosses to the opposite side and gives off collaterals to (a) the bulbar nuclei, (b) to the mid-brain. From the optic thalamus the impulses travel to the cerebral cortex by the way of neurones of the third order, however some of those of the second order may pass through the optic thalamus to the cerebral cortex uninterrupted. Thus we see two neurone systems may carry the impulses to the cortex or it may take three. Muscle and joint sensations travel through these tracts. This **route is direct** because it does not travel through the cerebellum.

(2.) After passing through neurones of the first order by the way of collaterals to the gray matter of the anterior horn, the impulses travel through the **ANTERO-LATERAL- GROUND BUNDLE** (fasciculi proprii) by neurones of the second order to the optic thalamus. While in the posterior longitudinal bundle (fasciculus longitudinalis medialis) collaterals are given to the bulbar nuclei and mid-brain. From the optic thalamus neurones of the third order pass to the cortex. This **route is direct** and conveys cutaneous and painful sensations.

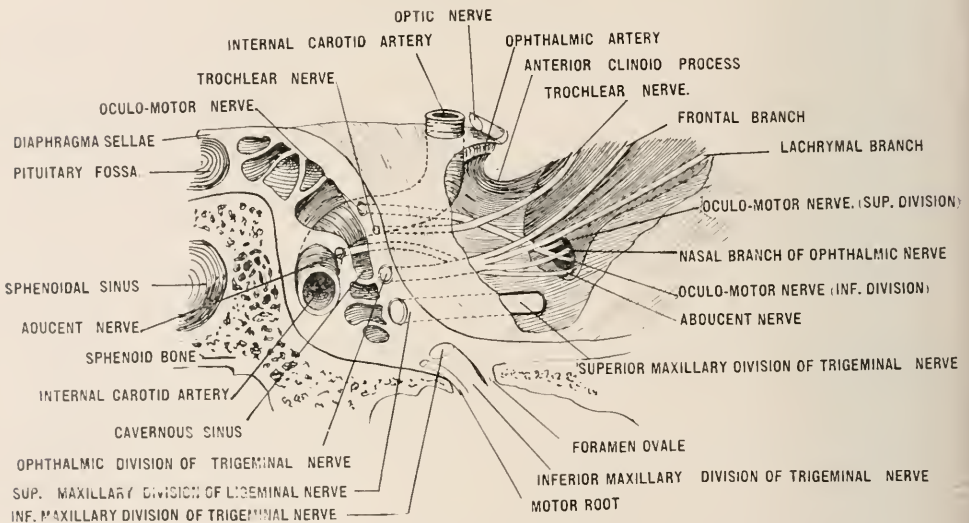
(3.) After passing through neurones of the first order by the way of collaterals to the cells of gray matter of the cord, they travel by the way of **THE TRACTS OF GOWER'S** (antero-lateral ascending) by neurones of the second order through the dorsal region of the pons and medulla to mid-brain and optic thalamus. From the optic thalamus neurones of the third order complete the

course to the cortex. This route is direct and conveys cutaneous and painful sensations.

LESSON CXXIX. (Plate CCXXX).

(4.) This route is indirect because it passes through the cerebellum. Neurones of the first order carry impulses to nuclei gracilis et cuneatus by way of tracts of GOLL AND BURDACH just as in the direct route. From here neurones of the second order through the restiform bodies (inferior peduncles of the cerebellum) of the same or opposite side to the vermis, giving off collaterals to the nuclei in the cerebellum, such as nucleus dentatus. Impulses now pass from

PLATE CCXXXII.



THE CAVERNOUS SINUS (MODIFIED FROM CUNNINGHAM.)

the vermis to the nucleus dentatus by way of neurones of the third order. From the nucleus dentatus impulses pass to the red nucleus of the opposite side through the superior peduncles. This is done by means of neurones of the fourth order. From the red nucleus neurones of the fifth order pass to the optic thalamus. From the optic thalamus neurones of the sixth order pass to the cortex.

(5.) These impulses pass in THE DIRECT CEREBELLAR TRACT (fasciculus spino-cerebellaris dorso-lateralis) then through the inferior peduncles of the cerebellum to the vermis of the same and opposite side by means of neurones of the second order. Collaterals are given off to the nucleus dentatus. From the vermis neurones of the third order pass to the nucleus dentatus and from here by neurones of the fourth order to the red nucleus. From the red nucleus to the optic thalamus by neurones of the fifth order and from the optic thalamus to the cortex by neurones of the sixth order. Neurones of the first order transmit impulses to cells in the columns of Clark by the way of collaterals. This route is indirect because it passes through the cerebellum.

(6.) In this route impulses pass UP GOWER'S TRACT (fasciculus spino-cerebellaris ventro-lateralis) by neurones of the second order to the mid-brain. From here they reach the superior worm by the way of the superior peduncles of the cerebellum. The remainder of the route is the same as that in route 4 and 5. Neurones of the first order give collaterals to cells of the gray matter. The indirect route may take SIX NEURONE SYSTEMS to complete its course while the direct takes ONLY THREE. This **route is indirect** because it passes through the cerebellum.

LESSON CXXX. (Plate CCXXXI).

The **motor impulses**, which are efferent (centrifugal) take the following routes:

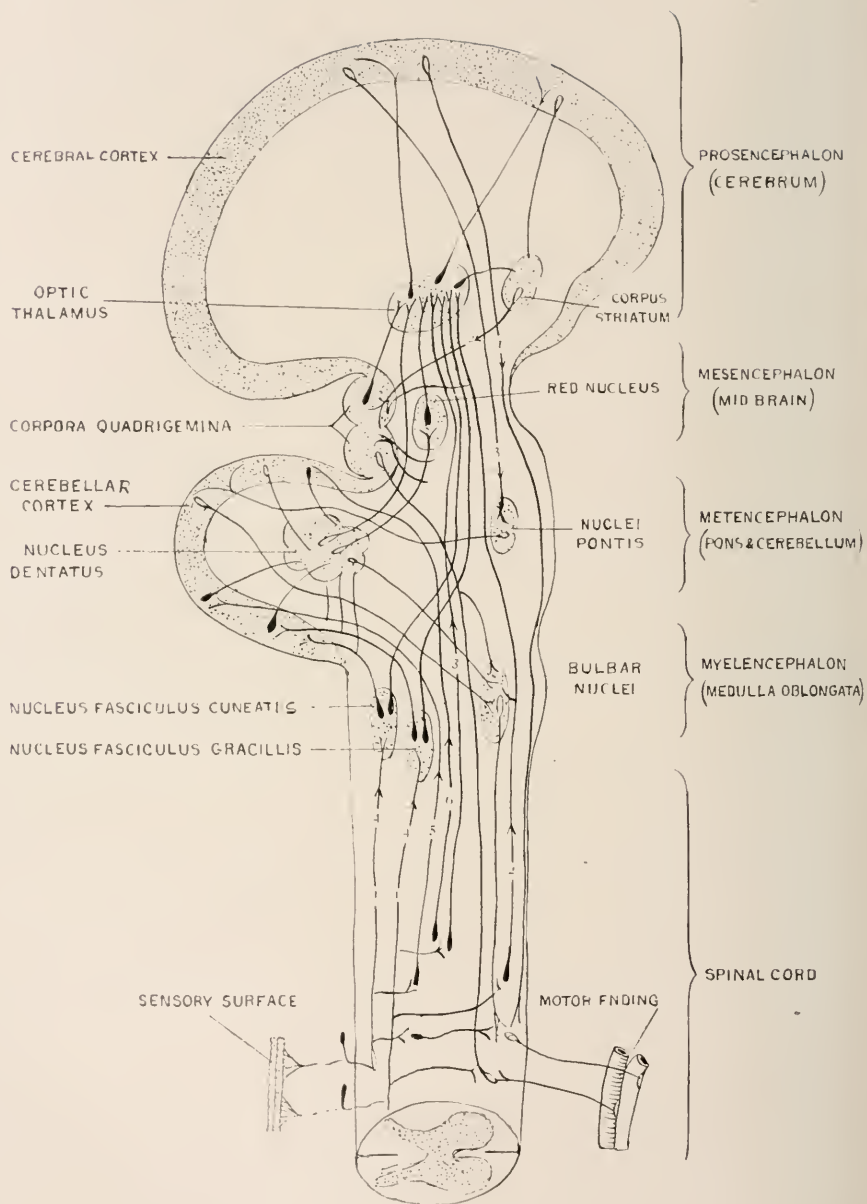
(1.) BY THE WAY OF THE PYRAMIDAL TRACT WITHOUT PASSING THROUGH THE CEREBELLUM. This **route is direct**.

Impulses in this route pass from the cortex through the corona radiata, internal capsule, and pyramidal tracts to the lower end of the medulla by neurones of the first order. From the lower end of the medulla the fibers pass in the following ways: (a) most of them cross to the opposite side in the decussation of the pyramid to descend in the crossed pyramidal tract (fasciculus cerebro-spinalis lateralis) to end in the gray matter of the anterior horn. (b) some of the fibers descend in the direct pyramidal tract (fasciculus cerebro-spinalis ventralis) to end in the gray matter of the anterior horn. (c) the remaining fibers descend in the crossed pyramidal tract of the same side to end in the gray matter of the anterior horn. From the cells in the gray matter of the anterior horn neurones of the second order carry impulses to the muscle. Thus we see that two neurone systems will carry a motor impulse from the cortex to the muscle.

(2.) BY THE WAY OF CORPUS STRIATUM AND MID-BRAIN WITHOUT PASSING THROUGH THE CEREBELLUM. This **route is direct**.

These impulses pass by neurones of the first order to the corpus striatum. Most of these come from the frontal region. They now pass by neurones of the second order to the mid-brain. From the mid-brain impulses pass by neurones of the third order by the antero-lateral descending tract to end in the gray matter of the anterior horn. Neurones of the fourth order now carry the impulse to the muscles over the anterior roots of the spinal nerves.

(3.) BY WAY OF THE PYRAMIDAL TRACT, NUCLEI PONTIS, CEREBELLUM, BULBAR NUCLEI. This route passes through the cerebellum therefore it is an **indirect route**. Impulses pass by the neurones of the first order through the corona radiata, internal capsule, and pyramidal tract to the pons. From the pontis nuclei impulses pass by the middle peduncles to the cortex of the opposite side of the cerebellum. From here neurones of the third order carry the impulses to the dentate nucleus. Neurones of the fourth order pass from the dentate nucleus to the bulbar nuclei. Neurones of the fifth order pass from the bulbar nuclei to end in the gray matter of the anterior horn and from here neurones of the sixth order pass to the muscles.



SHOWING BOTH SENSORY AND MOTOR PATHWAYS.

(Modified from Eckley-Jackson.)

Every sensory point of the body is connected to every motor point by a reflex pathway, and all nerve impulses conform to the reflex type.

A **reflex impulse** may pass over many different paths between any given sensory point and motor point. (Plate CCXXXII) shows both afferent and efferent pathways.

The brain is a collection of gray ganglia connected by white commissures. (Note). The middle commissure is gray, but it is not a commissure in the true sense because it has not fibers in it.

When we can name and define the commissures of the brain and give the boundaries of all the ventricles and describe each structure which helps to make these boundaries, then we understand something of the brain.

LESSON CXXXI.

The Transverse Commissures are:

1. Anterior commissure. See page 347
2. Middle commissure. See page 348
3. Posterior commissure. See page 348
4. Optic commissure. See page 366
5. Corpus callosum. See page 350
6. Pons varolii. See page 362
7. Fornix, also longitudinal. Page 348
8. Sup. or ant. medullary velum
(valve of Vieussens.)
9. Inf. or post. medullary velum

The Longitudinal commissures are:

1. Olfactory tracts. See page 365
2. Tænia Semicircularis. See page 356
3. Crura cerebri. See page 363
4. Processus-e-cerebello-ad-testes. See page 354
5. Peduncles of pineal gland.
6. Fornix. See page 348
7. Gyrus Fornicatus.
8. Lamina cinerea. See page 345
9. Infundibulum.
10. Fasciculus uniformis.

LESSON CXXXII.

THIRD VENTRICLE.

ROOF.

1. Corpus callosum. See page 350
2. Fornix. See page 348
3. Velum interpositum (Tela choroidea superior). See page 351
4. Epithelium.

FLOOR.

1. Tegmental portion of the diverging crura cerebri. See page 363
2. Posterior perforated space
3. Corpora albicantia. See page 349
4. Tuber cinereum.
5. Infundibulum.
6. Lamina cinerea (anterior wall).

ANTERIOR BORDER.

1. Anterior commissure. See page 347
2. Anterior pillars of fornix. Page 349
3. Foramen of Monro. See page 341

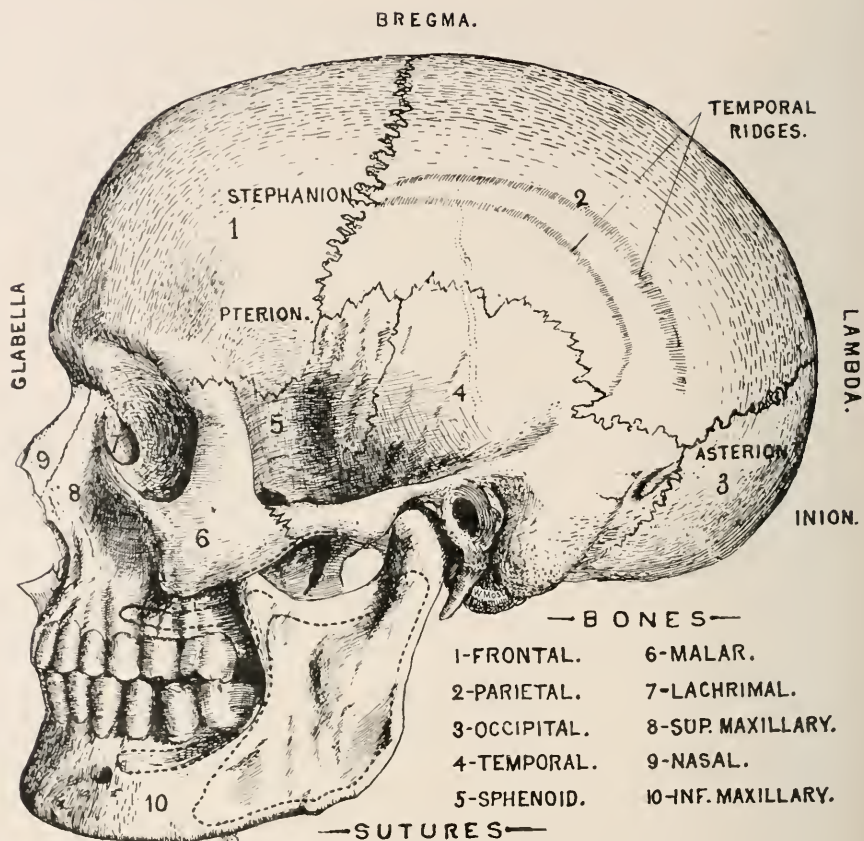
POSTERIOR BORDER.

1. Posterior commissure. Page 348
2. Aqueduct of Sylvius. Page 341
3. Epithelium from pineal body to velum interpositum (tela choroidea superior).

SIDES.

1. Optic thalamus. See page 352

PLATE CCXXXIV.



CORONAL- FROM PTERION TO PTERION. BETWEEN FRONTAL AND PARIETALS.

SAGITTAL- FROM BREGMA TO LAMBDA - BETWEEN THE PARIETALS.

LAMBDOID- FROM ASTERION TO ASTERION BETWEEN PARIETAS AND OCCIPITAL.

THE SUTURES OF THE SKULL.

LESSON CXXXIII.

LATERAL VENTRICLE.

ROOF.

1. Corpus callosum. See page 350

FLOOR.

1. Caudate nucleus.
2. Tania semicircularis. See page 356
3. Lamina cornea.
4. Choroid plexus.
5. Optic thalamus. See page 352
6. Fornix. See page 348

OUTER SIDE.

1. Corpus callosum. See page 350

INNER SIDE.

1. Corpus callosum. See page 350
2. Fornix. See page 348
3. Septum lucidum. See page 351

LESSON CXXXIV.

FOURTH VENTRICLE.

The roof or posterior boundary is formed by the cerebellum and has the following points for consideration:

1. Superior peduncles of cerebellum. See page 354
2. Valve of Vieussens, anterior or superior medullary velum.
3. White matter of vermiform process of cerebellum.
4. Inferior medullary velum.
5. Epithelial lining of choroid plexus.
6. Tela choroidea inferior.
7. Obex.
8. Ligulæ.

The floor or anterior boundary is formed by the pons and medulla and has the following points for consideration:

1. Eminentia teres.
2. Fovea superior.
3. Conductor sonorus.
4. Locus cæruleus.
5. Fovea inferior.
6. Ala cinerea (trigonum vagi.)
7. Trigonum hypoglossi.
8. Tuberculum acusticum.

LESSON CXXXV.

The **first cranial nerve** is called olfactory. It leaves the cranium through the cribriform plate of the ethmoid. One disease of this nerve is called anosmia.

The **second cranial nerve** is called optic. It leaves the cranium through the optic foramen. One disease of this nerve is optic neuritis.

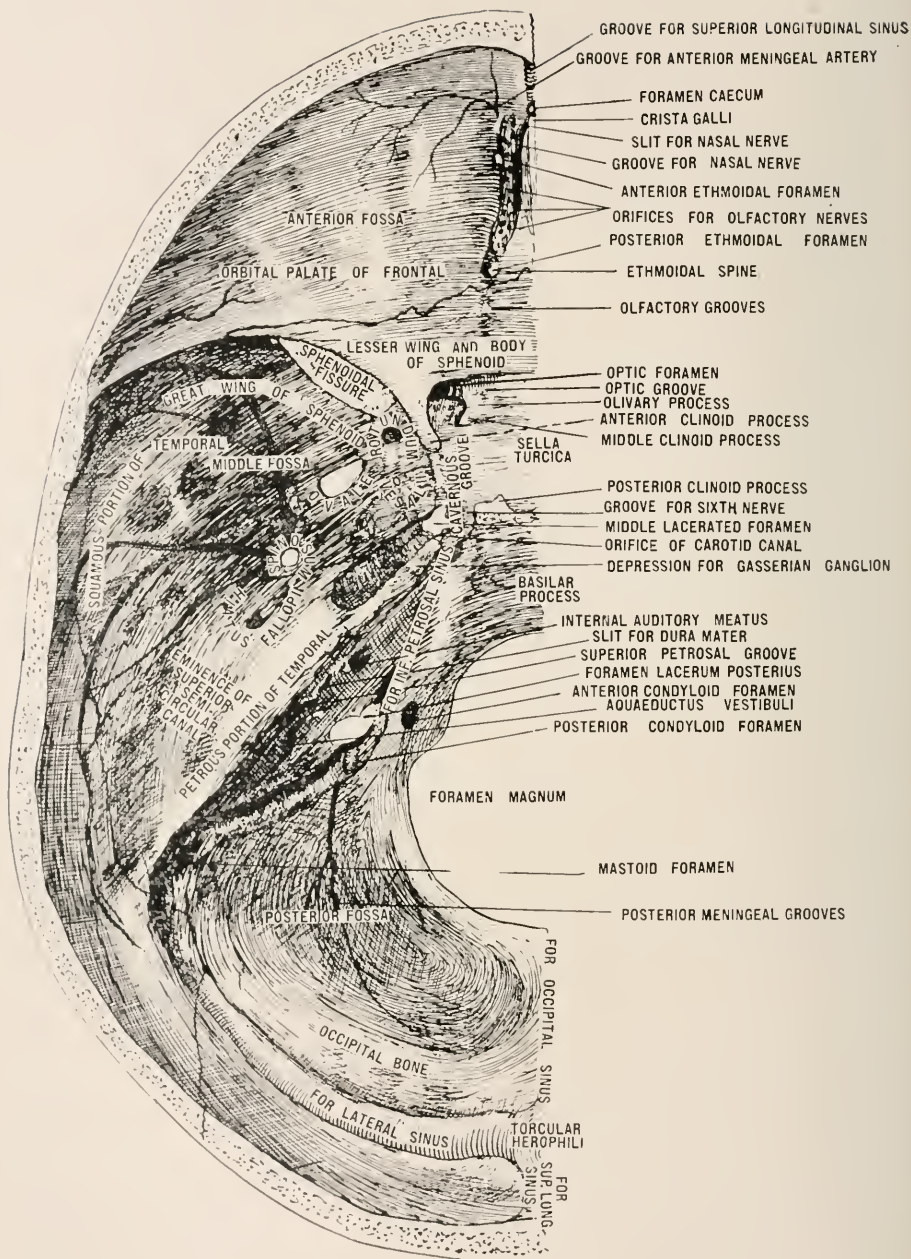
The **third cranial nerve** is called motor oculi. It leaves the cranium through the anterior lacerated (sphenoidal) fissure. Paralysis of this nerve will cause ptosis.

The **fourth cranial nerve** is called trochlear. It leaves the cranium through the anterior lacerated (sphenoidal) fissure. Paralysis of this nerve will cause diplopia.

The **fifth cranial nerve** is called trifacial. The ophthalmic division leaves the cranium through the sphenoidal fissure. This division of the nerve is subject to malarial and septic poisons. The superior maxillary division leaves the cranium through the foramen rotundum. The inferior maxillary division leaves the cranium through the foramen ovale. These last two divisions are subject to rheumatic influences. The fifth nerve is involved in tic-douloureux, neuralgia, and toothache.

The **sixth cranial nerve** is called abducens. It leaves the cranium through the anterior lacerated (sphenoidal) fissure. Paralysis of this nerve will cause convergent squint.

The **seventh cranial nerve** is called facial. It starts to leave the cranium through the internal auditory meatus and after passing through the aqueduc-



SHOWING FORAMINA AT THE BASE OF THE SKULL.

tus Fallopii it passes through the stylo-mastoid foramen. This nerve may be paralyzed after it leaves the stylo-mastoid foramen, or during its passage through the petrous portion of the temporal bone, or at its origin in the brain. In any of these cases it is called Bell's paralysis. Paralysis of this nerve in the brain is also called bulbar paralysis.

The **eighth cranial nerve** is called auditory. It starts to leave through the internal auditory meatus but stays in the internal ear. One disease of this nerve is deafness.

The **ninth cranial nerve** is called glosso-pharyngeal. It leaves the cranium through the middle compartment of the jugular foramen. Loss of taste is ageusia.

The **tenth cranial nerve** is called pneumogastric. It leaves the cranium through the middle compartment of the jugular foramen. One thing that may happen when this nerve does not perform its function is asthma.

The **eleventh cranial nerve** is called spinal accessory. It leaves the cranium through the middle compartment of the jugular foramen. Paralysis of this nerve causes spasmodic torticollis.

The **twelfth cranial nerve** is called hypoglossal. It leaves the cranium through the anterior condyloid foramen. Paralysis of this nerve causes motor aphasia.

The **following** are the descriptions of those parts of the brain not previously given.

(1) **VALVE OF VIEUSSENS** is a thin leaf of medullary substance between the superior peduncles of the cerebellum. It is also called anterior or superior medullary velum.

(2) **POSTERIOR OR INFERIOR MEDULLARY VELUM** is the commissure of the flocculus of the cerebellum.

(3) **POSTERIOR PERFORATED SPACE** is the depression just behind the corpora albicantia at the base of the brain. The arteries which pass through this space pass to the optic thalamus. It would be better to call it the posterior perforated substance.

(4) **TUBER CINEREUM** is a tract of gray matter extending from the optic commissure to the corpora albicantia, and it is one of the structures in the floor of the third ventricle.

(5) **LAMINA CINEREA** is a connecting layer of gray matter between the corpus callosum and the optic commissure.

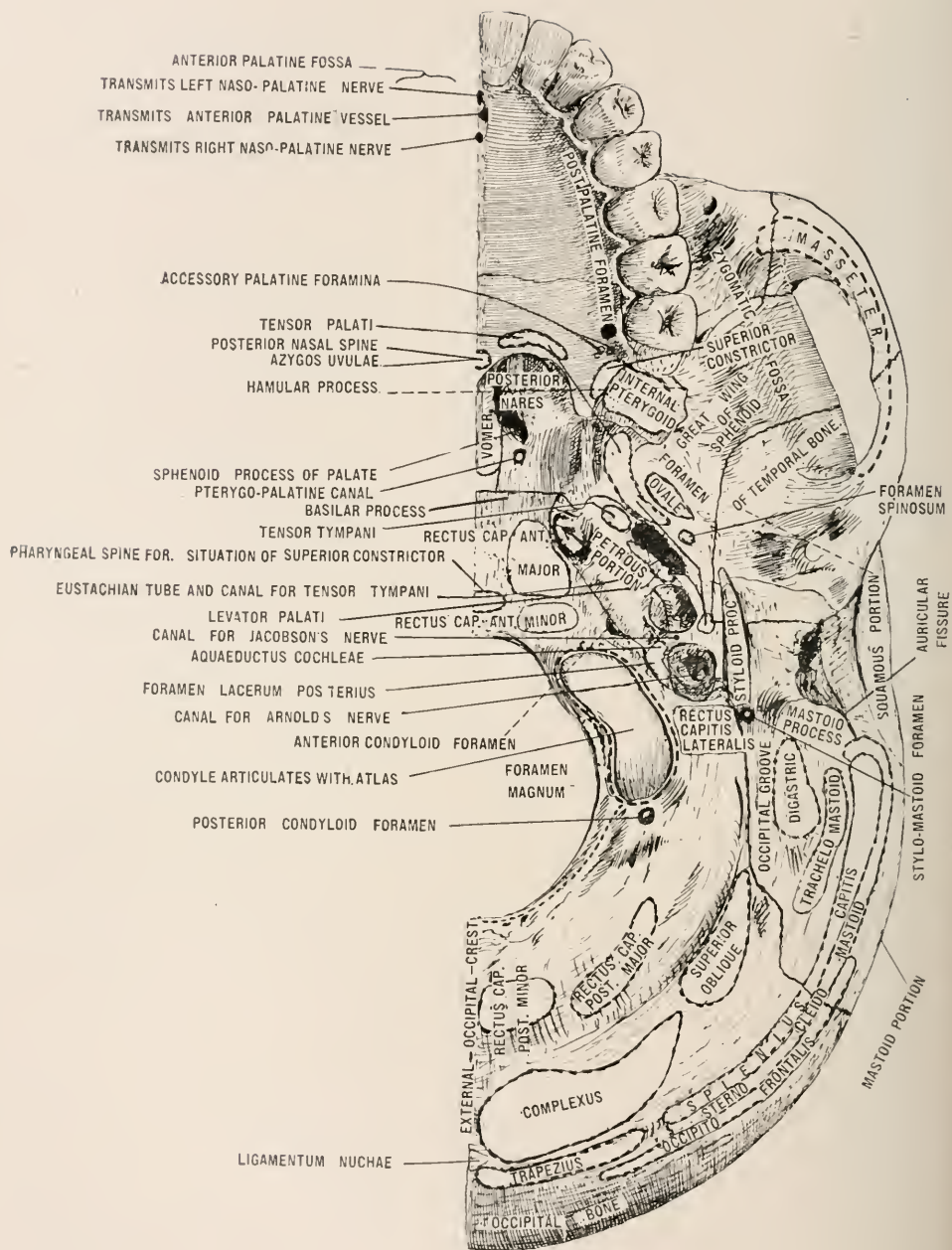
(6) **INFUNDIBULUM** is a funnel shaped process of the brain passing from the tuber cinereum to the pituitary body.

(7) **CORPUS STRIATUM** consists of the caudate nucleus, the lenticular nucleus, and the internal capsule, and is situated opposite the fissure of Sylvius.

(8) **CHOROID PLEXUSES** are vascular plexuses in the ventricles of the brain.

(9) **TELA CHOROIDEA INFERIOR** is the membranous part of the roof of the fourth ventricle.

(10) **PEDUNCLES OF THE PINEAL GLAND** are delicate white bands passing forward from each side of the pineal gland along the edge of the third ventricle to join the anterior pillars of the fornix.



THE INFERIOR SURFACE OF BASE OF SKULL.

(11) **OBEX** is a band of gray nervous matter at the point of the calamus scriptorius. The calamus scriptorius is the groove on the floor of the fourth ventricle, at the end of which is the ventricle of Arantius.

(12) **LIGULÀ** is the tongue shaped organ of white matter on the lower part of the roof of the fourth ventricle.

(13) **FOVEA SUPERIOR** is a depression in the floor of the fourth ventricle on the outer side of the eminentia teres.

(14) **FOVEA INFERIOR** is a depression with its apex at the striæ, which cross the center of the floor of the fourth ventricle, and its base below.

(15) **EMINENTIA TERES** is on each side of the median line on the upper half of the floor of the fourth ventricle. It is produced by an underlying bundle of white fibers (funiculus teres) formed by fibers of the faeial nerve.

(16) **CONDUCTOR SONORUS** is formed by a whitish band of fibers which are connected below with the striæ medullaris.

(17) **ALA CINEREA** (trigonum vagi) is a depression below the inferior fovea.

(18) **TRIGONUM HYPOGLOSSI** is situated on the inner side of the inferior fovea.

(19) **TUBERCULUM ACUSTICUM** is situated on the outer side of the inferior fovea.

(20) **FASCICULUS UNCIFORMIS** connects the parietal lobe with the temporal lobe, and is situated in the bottom of the fissure of Sylvius.

(21) **LOCUS CERULEUS** is a bluish depression above the fovea superior.

LESSON CXXXVI.

THE RELATIONS OF THE EXTERNAL CAROTID ARTERY. (Plates CXVI-CXVII-CXVIII).

IN FRONT.—(1) Skin, (2) Superficial fascia, (3) Platysma and deep fascia, (4) Anterior border of Sterno-mastoid, (5) Hypoglossal nerve, (6) Lingual vein, (7) Facial vein, (8) Digastric muscle, (9) Stylo-hyoid muscle, (10) Parotid gland with facial nerve and temporo-maxillary vein in its substance.

BEHIND.—(1) Superior laryngeal nerve, (2) Stylo-glossus, (3) Stylo-pharyngeus, (4) Glosso-pharyngeal nerve, (5) Parotid gland.

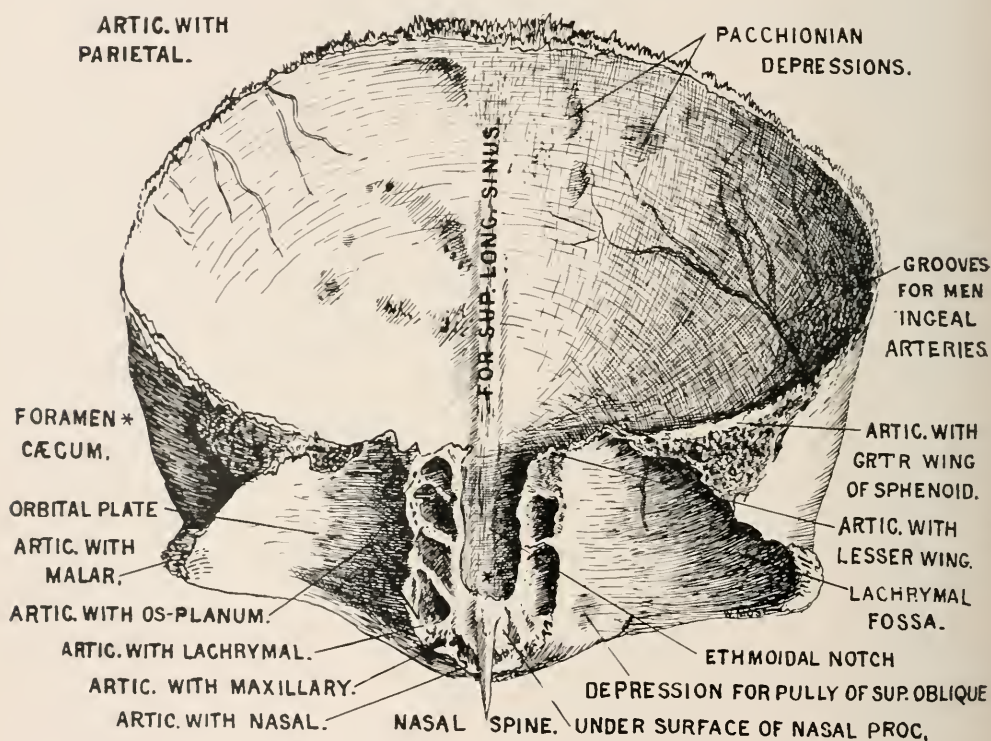
EXTERNALLY.—Internal carotid artery.

INTERNALLY.—(1) Hyoid bone, (2) Pharynx, (3) Superior laryngeal nerve, (4) Parotid gland, (5) Ramus of jaw.

The INTERNAL CAROTID ARTERY (Plates CXVI-CXVII-CXVIII) which begins at the upper border of the thyroid cartilage is divided for convenience into four parts. (1) The **cervical portion** passes vertically upward in front of the transverse processes of the three upper cervical vertebrae to enter the carotid canal in the petrous portion of the temporal bone. This portion has no branches. (2) The **petrous portion** passes in the carotid canal where it runs forward and inward in front of the tympanum and from here ascends to the cavernous sinus. This portion gives off the **TYMPANIC BRANCH**, which runs through a small foramen in the wall of the carotid canal to enter the tympanum. (3) The **cavernous portion** passes in the cavernous sinus to the posterior clinoid process and from here along the body of the sphenoid bone and then passes

upward on the inner side of the anterior clinoid process where it leaves the cavernous sinus. This portion gives off (a) THE ARTERIÆ RECEPTACULI BRANCHES which pass to the pituitary body, Gasserian ganglion, and to the walls of the cavernous sinus and inferior petrosal sinus, (b) ANTERIOR MENINGEAL which passes over the lesser wing of the sphenoid to the dura mater in the anterior fossa, (c) OPHTHALMIC—this artery has been described on page 383, (4) The cerebral portion enters the fissure of Sylvius and gives off (a) ANTERIOR CEREBRAL which runs in the longitudinal fissure around the corpus callosum to its posterior part. (Plate CLXXIII.) THE ANTERIOR COMMUNICATING ARTERY

PLATE CCXXXVII.



INTERNAL SURFACE OF FRONTAL BONE.

joins this artery with its fellow near their beginning. This artery gives off the antero-median ganglionic, which passes through the anterior perforated space, and lamina cinerea to the caudate nucleus of the corpus striatum. It also gives off the antero-internal frontal, which passes to the two inferior frontal lobes; and the middle internal frontal, which passes to the corpus callosum and to the inner surface of the ascending frontal lobe and first frontal lobe; and it finally gives off the posterior internal frontal which passes to the quadrate lobe. (b) MIDDLE CEREBRAL, (Plates CLXXIII-CLXXV) which runs outward in the fissure of Sylvius and gives off its branches near the central lobe. Its branches

are antero-lateral ganglionic which passes to the corpus striatum, internal capsule and optic thalamus; external and inferior frontal which pass to the third frontal convolution; ascending frontal which passes to the ascending frontal convolution; the ascending parietal which passes to the ascending parietal convolution; and parieto-sphenoidal which passes to the angular convolution and the superior temporo-sphenoidal convolution. (c) THE POSTERIOR COMMUNICATING ARTERY, (Plate CLXXIII) which runs backward and joins the posterior cerebral artery. It sends postero-median ganglionic branches which pass through the posterior perforated space, the optic thalamus and wall of the third ventricle. (d) ANTERIOR CHOROID ARTERY which runs backward into the descending horn of the lateral ventricle. (Plate CLXXIII.)

The **circle of Willis** is formed by seven arteries which make an enclosure at the base of the brain just beneath the third ventricle. All the structures in the floor of the third ventricle are in the circle of Willis except the tegmental portion of the crus, and everything in the circle of Willis is in the floor of the third ventricle except the optic commissure. The arteries that make this circle are the two posterior cerebral from the basilar; the two anterior cerebral which are branches of the internal carotid; the two posterior communicating and the anterior communicating which is the shortest artery in the body and has upon it ganglion of Ribes.

The **posterior cerebral** which are branches of the basilar artery wind around the crus cerebri to the under surface of the occipital lobe. Here it sends branches (a) TO THE UNCINATE LOBE, (b) TO THE CUNEATE LOBE, (c) TO THE TEMPORAL LOBE. Near its origin it receives the posterior communicating artery. The postero-median ganglionic branches pass from the posterior cerebral through the posterior perforated space to the walls of the third ventricle. A posterior choroid branch comes from the posterior cerebral and passes to the velum interpositum and choroid plexus. A postero-lateral ganglionic branch comes from the posterior cerebral and passes to the optic thalamus.

LESSON CXXXVII

THE RELATIONS OF THE INTERNAL CAROTID ARTERY.

IN FRONT.—(1) Skin, (2) Superficial and deep fascia, (3) Platysma, (4) Sterno-mastoid, (5) Occipital artery, (6) Posterior auricular artery, (7) Hypoglossal nerve, (8) Parotid gland, (9) Stylo-glossus, (10) Stylo-pharyngeus, (11) Glosso-pharyngeal nerve, (12) Pharyngeal branch of the pneumogastric.

BEHIND.—(1) Rectus capitis anticus major, (2) Sympathetic, (3) Superior laryngeal nerve.

EXTERNALLY.—(1) Internal jugular vein, (2) Pneumogastric nerve.

INTERNALLY.—(1) Pharynx, (2) Superior laryngeal nerve, (3) Ascending pharyngeal artery, (4) Tonsil.

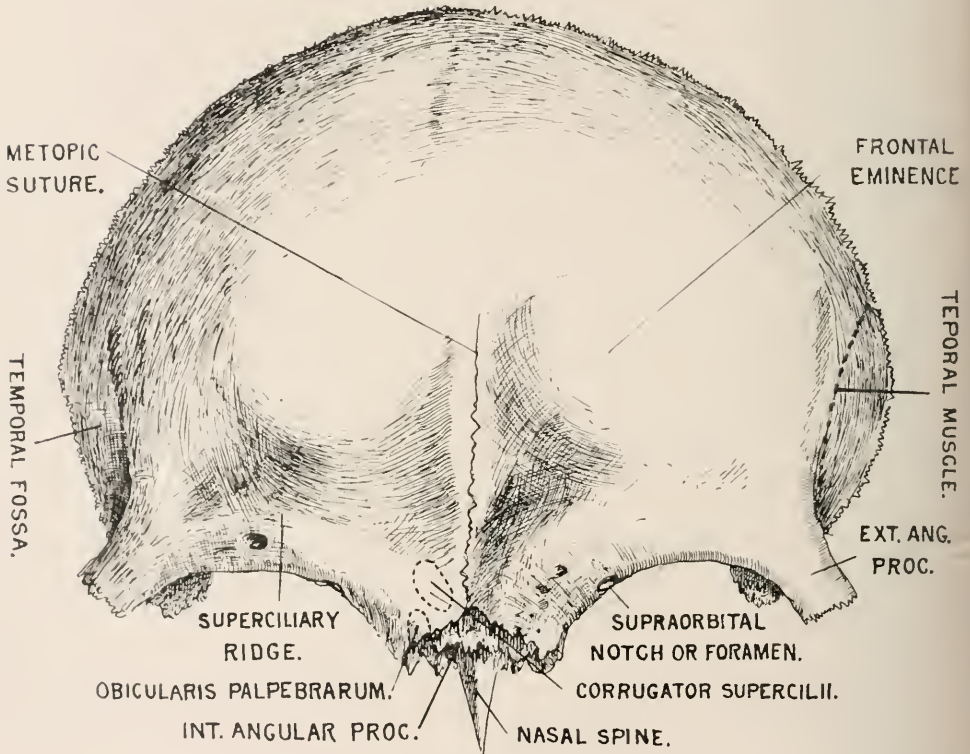
The **Right subclavian artery** arises from the innominate opposite the sterno-clavicular articulation and passes upward and outward to the Scalenus anticus muscle on the right side. The **left Subclavian artery** arises from the end of the arch of the aorta and ascends to the Scalenus anticus muscle. The artery

now runs outward behind the *Scalenus anticus* muscle then downward under the clavicle to the lower border of the first rib where it takes the name of axillary. The *Scalenus anticus* muscle divides this artery into three portions. The portion internal to the muscle is the first portion, the portion behind it is the second portion, and the portion external to it is the third portion.

THE RELATIONS OF FIRST PORTION OF THE RIGHT SUBCLAVIAN ARTERY.

IN FRONT.—(1) Skin, (2) Superficial fascia, (3) *Platysma* and deep fascia, (4) Clavicular origin of *Sterno-mastoid*, (5) *Sterno-hyoid*, (6) *Sterno-thyroid*, (7) Anterior jugular, (8) Internal jugular, (9) Vertebral veins, (10) *Pneu-*

PLATE CCXXXVIII.



EXTERNAL SURFACE OF FRONTAL BONE.

mogastric nerve, (11) Cardiac nerves, (12) Loop from the sympathetic.

BEHIND.—(1) Recurrent laryngeal nerve, (2) Sympathetic, (3) Pleura (4) Apex of lung.

BENEATH.—(1) Pleura, (2) Recurrent laryngeal nerve.

THE RELATIONS OF FIRST PORTION OF LEFT SUBCLAVIAN ARTERY.

IN FRONT.—(1) *Pneumogastric* nerve, (2) Cardiac nerves, (3) *Phrenic* nerve, (4) Left carotid artery, (5) Thoracic duct, (6) Left internal jugular, (7) Vertebral vein, (8) *Innominate* vein, (9) *Sterno-thyroid*, (10) *Sterno-hyoid*, (11) *Sterno-mastoid*.

BEHIND.—(1) *Oesophagus*, (2) Thoracic duct, (3) Inferior cervical gang-

lion of sympathetic, (4) Longus colli.

OUTER SIDE.—(1) Pleura, (2) Left lung.

INNER SIDE.—(1) Trachea, (2) Œsophagus, (3) Thoracic duct.

LESSON CXXXVIII.

THE RELATIONS OF SECOND PORTION OF SUBCLAVIAN ARTERY ARE THE SAME ON EACH SIDE.

IN FRONT.—(1) Skin, (2) Superficial fascia, (3) Platysma and deep cervical fascia, (4) Sterno-mastoid, (5) Phrenic nerve, (6) Scalenus anticus, (7) Subclavian vein.

BEHIND.—(1) Pleura, (2) Scalenus medius.

ABOVE.—Brachial plexus.

BELOW.—Pleura.

THE RELATIONS OF THIRD PORTION OF SUBCLAVIAN ARTERY ARE THE SAME ON EACH SIDE.

IN FRONT.—(1) Skin, (2) Superficial fascia, (3) Platysma and deep cervical fascia, (4) Descending branches of cervical plexus, (5) Nerve to subclavius muscle, (6) Subclavius muscle, (7) Suprascapular artery, (8) Suprascapular vein, (9) The external jugular vein, (10) Transverse cervical vein, (11) Clavicle.

BEHIND.—(1) Scalenus medius, (2) Lower cord of brachial plexus.

ABOVE.—(1) Brachial plexus, (2) Omo-hyoid muscle.

BELOW.—First rib.

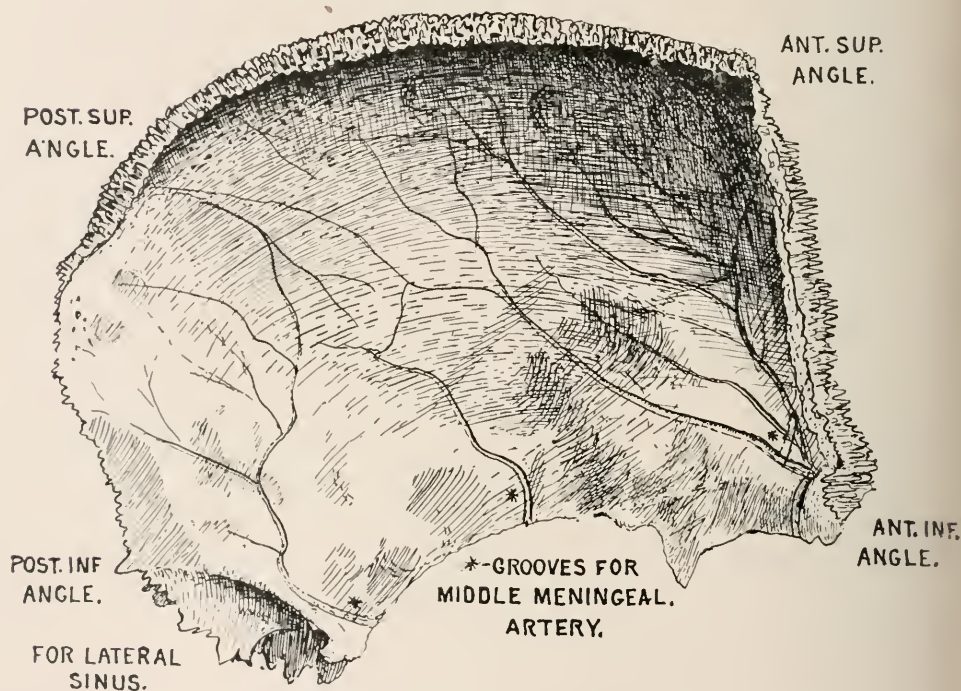
LESSON CXXXIX.

The **branches of the subclavian artery** are (1) **vertebral**, which arises at the upper and back part of the artery and passes upward through the foramina in the transverse processes of the upper six cervical vertebræ. After it passes through the foramen in the transverse process of the atlas, it passes behind the articular process of this bone in the sinus atlantis lying superficial to the suboccipital nerve. It now pierces the dura mater and passes through the foramen magnum of the occipital bone to the front of the medulla oblongata.

It unites with the opposite vertebral at the lower border of the pons to form the basilar artery. The branches of the vertebral artery are: (A) THE CERVICAL BRANCHES which send muscular branches to the neck, lateral spinal which pass through the intervertebral foramen and then divides into two branches one of which runs along the nerve roots to the cord and its coverings, the other divides into ascending and descending branches which form with similar branches from above and below loops on the posterior surfaces of the bodies of the vertebræ. (B) CRANIAL BRANCHES which send posterior meningeal branches to the posterior fossa, anterior spinal descends in front of the medulla and unites with its fellow to form a single trunk at the foramen magnum. This main branch descends in the anterior median fissure of the cord. For description of anterior spinal and posterior spinal see page 337. The posterior inferior cerebellar is the last branch of this cranial portion and winds around the medulla across the restiform body to the under surface of the cerebellum.

These two vertebral arteries unite to form the basilar artery, which runs in a groove in the middle of the pons to its anterior border where it divides into the posterior cerebral branch. The basilar artery gives off (A) NUMEROUS TRANSVERSE BRANCHES to the pons and adjacent parts, (B) THE INTERNAL AUDITORY ARTERY which runs with the auditory nerve in the internal meatus, (C) THE ANTERIOR INFERIOR CEREBELLAR ARTERY which crosses the crus cerebelli to the anterior border of the under surface of the cerebellum, (D) THE SUPERIOR CEREBELLAR which winds around the crus cerebri on each side near the fourth nerve to reach the upper surface of the cerebellum.

PLATE CCXXXIX.



INTERNAL SURFACE OF THE PARIETAL BONE.

(2) The internal mammary arises from the first portion of the subclavian artery opposite the thyroid axis and descends on the posterior surfaces of the costal cartilages to the sixth interspace where it divides into the musculo-phrenic and the superior epigastric branches. As it passes down it is about a half an inch from the sternal margin. The branches of the internal mammary are (a) COMES NERVI PHRENICI which accompanies the phrenic nerve to the Diaphragm, (b) THE MEDIASTINAL BRANCH which passes to the anterior mediastinum, (c) PERICARDIAC which passes to the anterior surface of the pericardium, (d) STERNAL BRANCHES which pass to the posterior surface of the sternum, (e) ANTERIOR INTERCOSTAL BRANCHES which pass to the five or six upper interspaces where each branch divides into two divisions to pass along the mar-

gins of the interspaces, (f) **PERFORATING BRANCHES** which pass through the five or six upper interspaces to the skin and muscles on the chest, and those that pass through the second, third, and fourth spaces go to the mammary gland.

Of its terminal branches the **musculo-phrenic** runs behind the cartilages of the false ribs to pierce the Diaphragm at the eighth or ninth rib and ends at the twelfth rib where it gives off anterior intercostals to the lower intercostal spaces pericardiac branches, and diaphragmatic branches.

Its other terminal branch the **superior epigastric** descends in the interval between the sternal and costal attachments of the Diaphragm to pierce the sheath of the Rectus muscle running on its posterior surface to anastomose with the deep epigastric in the substance of this muscle.

LESSON CXL.

(3) The **thyroid axis arises near the the Scalenus Anticus from the first portion of** subclavian artery and gives off inferior thyroid, suprascapular, and transversalis colli arteries.

The **inferior thyroid** artery ascends behind the middle cervical ganglion of the sympathetic and the sheath of the common carotid artery to the thyroid gland. It crosses the vertebral artery, Longus colli muscle, and the recurrent laryngeal nerve. It may, however, pass under this nerve. Its branches are, (a) **TRACHEAL**, which pass to the trachea, (b) **œsophageal**, which pass to the œsophagus, (c) **MUSCULAR**, which pass to the adjacent muscles, (d) **INFERIOR LARYNGEAL**, which passes to the back of the larynx with the recurrent laryngeal nerve, (e) **ASCENDING CERVICAL**, which passes between the Scalenus anticus muscle and the Rectus capitis anticus major on the anterior tubercles of the transverse processes.

The **suprascapular** artery crosses the Scalenus anticus muscle behind the clavicle and passes over the transverse ligament of the scapula to the supraspinous and infraspinous fossæ. This artery goes to the clavicle, scapula, and humerus, as well as to the sterno-clavicular articulation and acromio-clavicular articulation and the shoulder girdle.

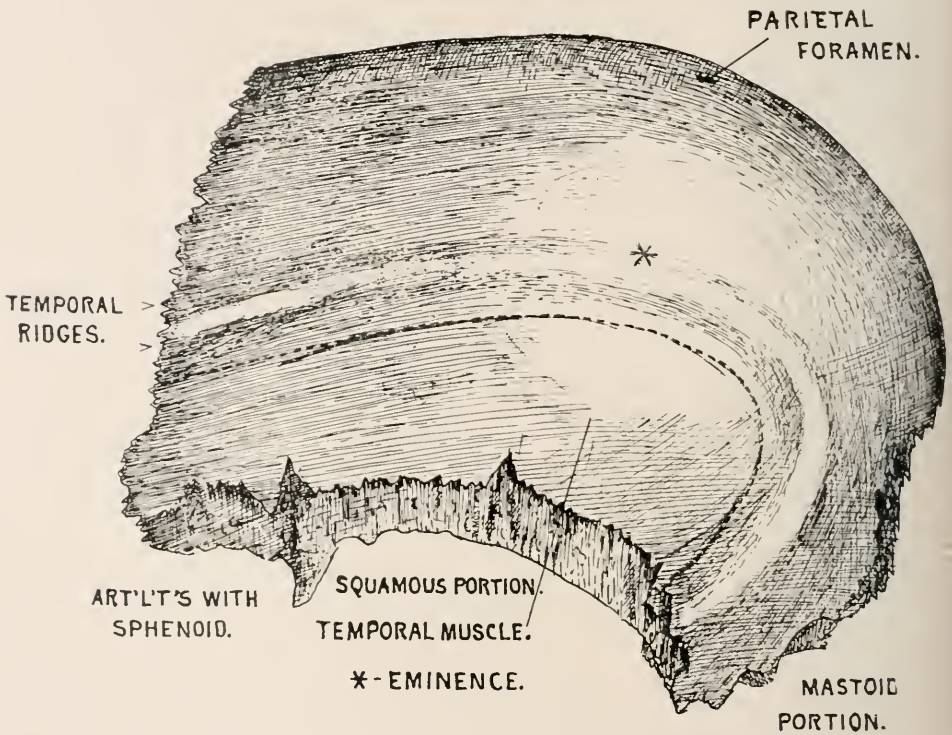
The **transversalis colli** is on a higher level than the suprascapular artery and crosses the Scalenus muscles and the brachial plexus to the Trapezius muscle. Here it divides two branches, (a) **SUPERFICIAL CERVICAL** which ascends under the anterior border of the Trapezius to anastomose with the superficial branch of the arteria princeps cervicis, (b) **THE POSTERIOR SCAPULAR** branch, which runs under the Levator anguli scapulae to the superior angle of the scapula and then descends under the Rhomboidei muscles to the inferior angle of the scapula. This artery may arise from the third portion of the subclavian.

(4) The **superior intercostal** comes from the upper and back part of the subclavian artery and descends on the neck of the first two ribs to supply the first two intercostal spaces. In the first intercostal space it gives off a branch which is distributed in like manner to the aortic intercostals. The artery in the second intercostal space generally joins one from the highest aortic intercostal. All intercostal arteries give off branches to the posterior

spinal muscles and a small one which passes to the spinal cord and its membrane. The profundus cervicis most always comes from the superior intercostal, but it may come from the subclavian artery itself. It ascends under the Complexus muscle as far the axis to anastomose with the deep branch of the arteria princeps cervicis.

THE RELATIONS OF THE THORACIC AORTA ARE GIVEN ON PAGE 286, and its branches are (1) **pericardiac**, which are small arteries and are distributed to the pericardium, (2) the **bronchial arteries** are nutrient arteries to the lungs. The one on the right side may come (A) FROM THE FIRST AORTIC INTERCOSTAL,

PLATE CCXL.



EXTERNAL SURFACE OF THE PARIETAL BONE.

(B) IT MAY COME BY A COMMON TRUNK WITH THE LEFT BRONCHIAL which comes from the front of the thoracic aorta. There are generally two on the left side. These arteries nourish the bronchial tubes, the cellular tissue of the lungs, the bronchial glands, and the œsophagus, (3) **œsophageal arteries** are generally four or five in number, and come from the front of the thoracic aorta and pass obliquely to the œsophagus. Above they anastomose with the inferior thyroid arteries, and below with branches from the phrenic and gastric arteries. (4) The **posterior mediastinal arteries** are small arteries which supply the glands in the posterior mediastinum.

LESSON CXLI.

(5) The **intercostal arteries** are eleven in number. Those of the first and second spaces come from the subclavian, and the remaining nine come from the thoracic aorta. The last one, which passes along the lower border of the last rib, is called the subcostal.

The **right intercostal arteries** are longer than the left ones because the aorta is situated on the left side of the spine. In each intercostal space the artery lies upon the External intercostal muscle and has in front of it the pleura and a thin fascia. From here it passes between the two layers of intercostal muscles and passes to the lower border of the rib above to pass forward in the groove on the lower border of this rib to anastomose with the anterior intercostals which are branches of the internal mammary. The first intercostal, which comes from the aorta, anastomoses with the superior intercostal, while the last three intercostals which come from the aorta pass between the abdominal muscles to anastomose with the epigastric in front and with the phrenic and lumbar arteries behind. In **each intercostal space** there is a vein, artery, and nerve, and their position from above down is vein, artery, and nerve, except in the upper intercostal spaces where the nerve is first above the artery. Fibrous arches keep the intercostal muscles from pressing upon the intercostal arteries during respiration. The lower intercostal arteries pass into the abdominal wall and into the sheath of the Rectus muscle where they anastomose with the internal mammary and the deep epigastric artery. The branches of the intercostal arteries are (a) THE POSTERIOR OR DORSAL BRANCH, which passes backward to the inner side of the anterior costo-transverse ligament where it is distributed to muscles and integument of the back after dividing into an external and internal branch. (b) THE SPINAL BRANCH, which passes through the intervertebral foramen to be distributed to the spinal cord and its coverings and the bodies of the vertebræ. (c) THE COLLATERAL INTERCOSTAL BRANCH arises from the intercostal artery close to the angle of the rib and then passes downward to the upper border of the rib below, along which it passes to anastomose with the anterior intercostals from the internal mammary.

The **thoracic aorta** commences on a level with the fourth dorsal vertebra and descends on the left side of the spine to pass through the abdominal opening in the Diaphragm after which it is called ABDOMINAL AORTA.

The **abdominal aorta** commences at the aortic opening in the Diaphragm extends to the front of the body of the fourth lumbar vertebra where it divides into THE RIGHT and LEFT COMMON ILIAC ARTERIES. (Plate XCI)

LESSON CXLII.

THE RELATIONS OF THE ABDOMINAL AORTA.

IN FRONT.—(1) Lesser omentum, (2) Stomach, (3) Branches of the cœliac axis, (4) Solar plexus, (5) Splenic vein, (6) Pancreas, (7) Left renal vein, (8) Transverse duodenum, (9) Mesentery, (10) Aortic plexus.

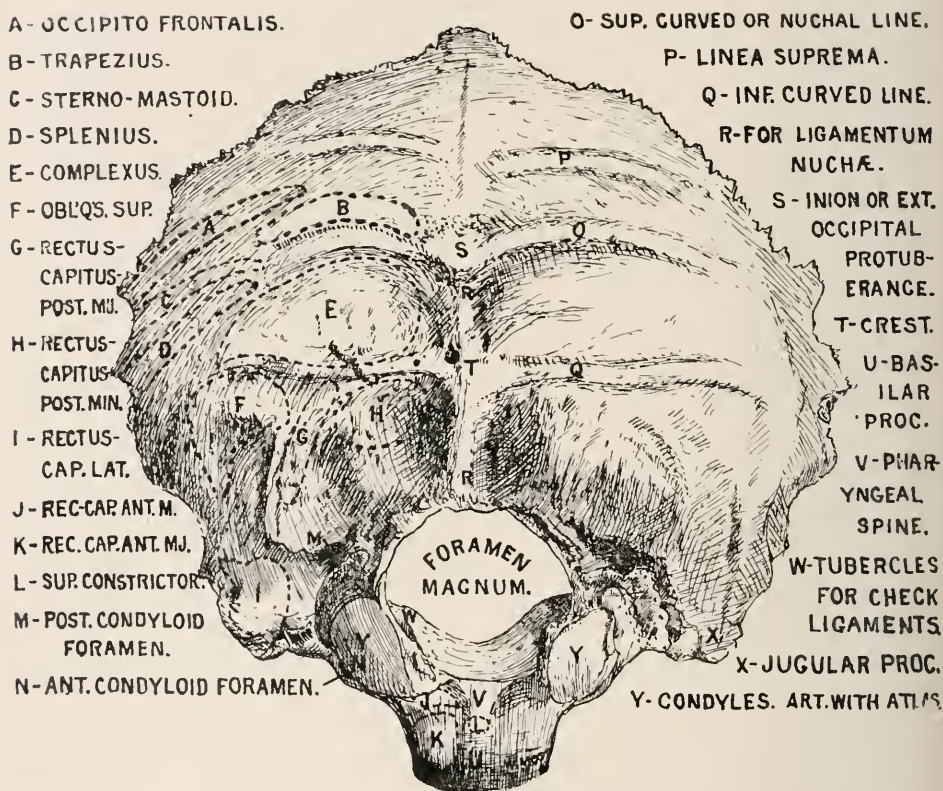
BEHIND.—(1) Left lumbar veins, (2) Vertebral column.

RIGHT SIDE.—(1) Right crus of Diaphragm, (2) Inferior vena cava, (3) Vena azygos major, (4) Thoracic duct, (5) Right semilunar ganglion.

LEFT SIDE.—(1) Left lumbar veins, (2) Left semilunar ganglion.

The branches of the abdominal aorta are (1) parietal branches and under this we have (A) PHRENIC BRANCHES which are two in number and as a rule arise close together on the under surface of the Diaphragm, but they present

PLATE CCXLI.



EXTERNAL SURFACE OF OCCIPITAL BONE.

much variation in their origin since they may come by a common trunk or one may come from the celiac axis and the other from the renal artery. The one on the right side passes across the crura of the Diaphragm to the under surface of that muscle behind the inferior vena cava, while the one on the left side passes behind the oesophagus to the under surface of the Diaphragm. (B) LUMBAR ARTERIES are five pairs and arise from the back of the aorta to pass outward on the body of the vertebrae beneath the Psoas magnus muscle and the sympathetic nerve. The first two pairs pass under the crura of the Diaphragm and the right one also passes under the inferior vena cava. Near the transverse processes of the vertebrae they divide into an abdominal branch, which passes outward beneath the Quadratus lumborum to end between the muscles of the abdominal wall where they anastomose with the deep epigastric, the internal mammary, the ilio-lumbar, and the circumflex iliac arteries. It is well to say

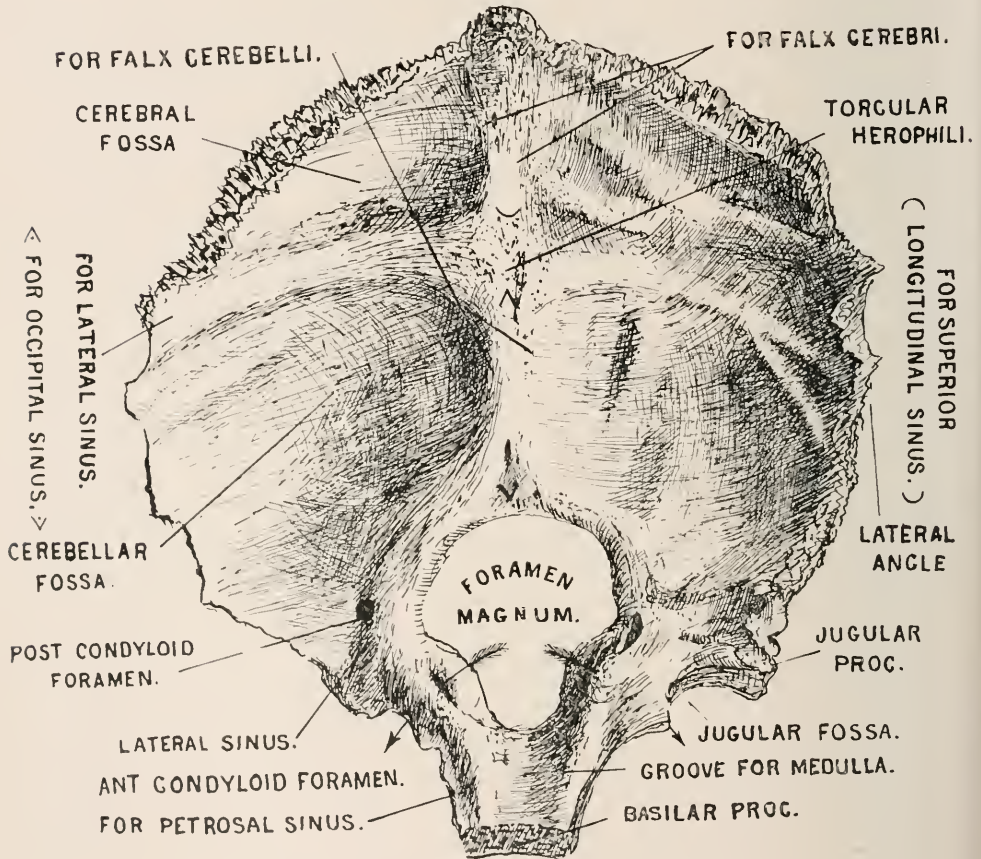
that the first pair cross the *Quadratus lumborum* muscle. The other branch is the dorsal branch which passes with the posterior primary branch of the intercostal nerve and gives off spinal branches which supply the spinal cord and its coverings. It anastomoses with the intercostal artery. (C) *SACRAMEDIA* is a small branch given off at the bifurcation of the abdominal aorta and passes over the fifth lumbar vertebra and the sacrum to the coccyx where it anastomoses with the lateral sacral arteries. (Plate XC.)

LESSON CXLIII.

(2) The **visceral branches** and under these we have (A) **cœliac axis**, which is a short trunk about a half of an inch long, arises between the crura of the Diaphragm just above the Pancreas. It passes horizontally forward and divides into three branches. **Gastric** or **coronary artery** is the smallest of these three branches and passes upward to the left side behind the lesser sac of the peritoneum to the cardiac end of the stomach. It also gives branches to the œsophagus, then turns to the right and passes along the lesser curvature of the stomach sending branches to both sides of the stomach. It anastomoses with the pyloric branch of the hepatic artery. **Hepatic artery** passes forward and upward between the layers of the lesser omentum to the transverse fissure in the liver where it divides into right and left hepatic branches to supply the lobes of the liver. In the fetus this is the largest of the branches of the cœliac axis because it supplies the liver which is such a large organ in the fetus. In the adult this artery is smaller than the splenic artery. The branches of the **hepatic artery** are **PYLORIC**, which extends along the lesser curvature of the stomach passing from right to left to anastomose with the gastric artery. **GASTRO-DUODENALIS** pass behind the first portion of the duodenum and divides into the following branches. **Gastro-epiploica dextra**, which runs along the greater curvature of the stomach from right to left to anastomose with the **gastro-epiploica sinistra** which is a branch of the splenic artery. This artery gives branches to both the stomach and the great omentum. **Pancreatico-duodenalis superior** passes between the second part of the duodenum and the pancreas. After supplying both of these organs, it anastomoses with the **pancreatico-duodenalis inferior** which is a branch of the superior mesentery and with the pancreatic branches of the splenic. **THE RIGHT HEPATIC** passes to the right lobe of the liver and gives off the cystic artery which supplies the gall bladder. **THE LEFT HEPATIC** passes to the left lobe of the liver and gives off branches to the Spigelian lobe. The **splenic artery** is the largest of the three branches of the cœliac axis and is very tortuous in its course. It passes along the upper border of the pancreas, crosses the left kidney to the spleen. It divides into **PANCREATICÆ PARVÆ**. These pancreatic branches supply the upper border of the pancreas while **THE PANCREATICA MAGNA**, which is a single large branch, passes from the left to the right near the posterior surface of the pancreas accompanying the pancreatic duct. **THE GASTRIC BRANCHES**, called **VASA BREVIA**, are five or six in number and pass to the left extremity of the stomach which it supplies. **GASTRO-EPIPLOICA SINISTRA** is the largest of the branches of the splenic artery and runs from left to right along the greater cur-

vature of the stomach between the layers of the great omentum. It anastomoses with the gastro-epiploica dextra and supplies both the greater omentum and the stomach. (B) **Superior mesentery** arises about one-fourth of an inch below the celiac axis and passes between the pancreas and the third portion of the duodenum which it crosses and passes downward to the right between the layers of the mesentery. It supplies all of the small intestine, except the first portion of the duodenum. It also supplies the cæcum, the ascending

PLATE CCXLII.

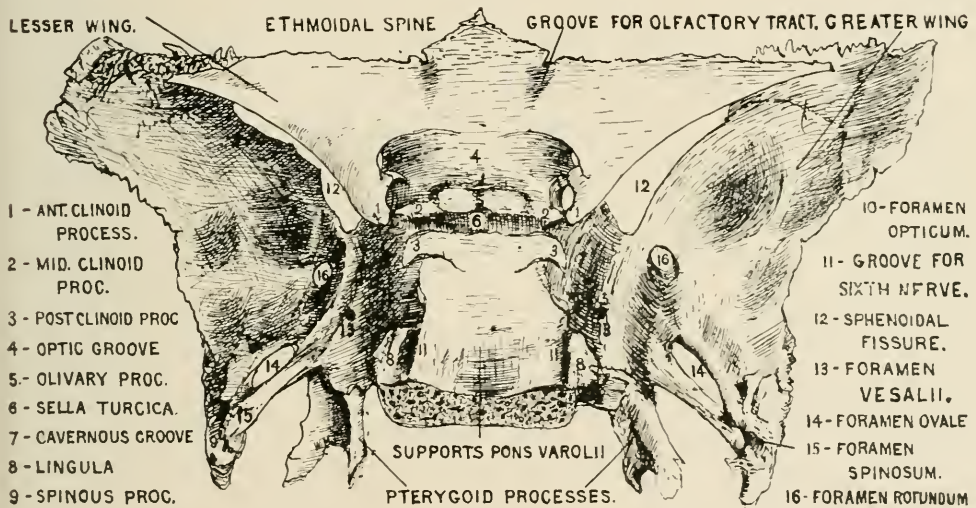


INTERNAL SURFACE OF OCCIPITAL BONE.

colon, the transverse colon. Its branches are **PANCREATICO-DUODENALIS INFERIOR**, which passes from left to right in the concavity of the duodenum where it anastomoses with the pancreatiko-duodenalis superior. It gives branches to the head of the pancreas and to the transverse and descending portions of the duodenum. **VASA INTESTINI TENUIS** are twelve or fifteen in number which come from the left convex side of the superior mesenteric artery to supply the jejunum and ileum. About two inches from their origin each branch divides and joins similar branches from the adjacent artery thus forming arches from

which numerous branches are given off to supply the mesentery and the small intestine. Four or five sets of arches are given off. THE ILIO-COLIC ARTERY is given off from the right side of the superior mesentery artery. It passes between the layers of the mesentery to the right iliac fossa where it divides into two ranches, ascending and descending. The ascending one passes to the ascending colon and anastomoses with the colica-dextra. The descending one passes to the lower part of the ileum, cæcum, appendix, and ileo-cæcal valve. THE COLICA-DEXTRA arises from the middle of the superior mesentery artery and passes behind the peritoneum to the ascending colon where it gives off an ascending branch which anastomoses with the colica-media, and a descending branch which anastomoses with the ileo-colic. COLICA-MEDIA comes from the upper part of the concavity of the superior mesenteric artery and passes for-

PLATE CCXLIII.

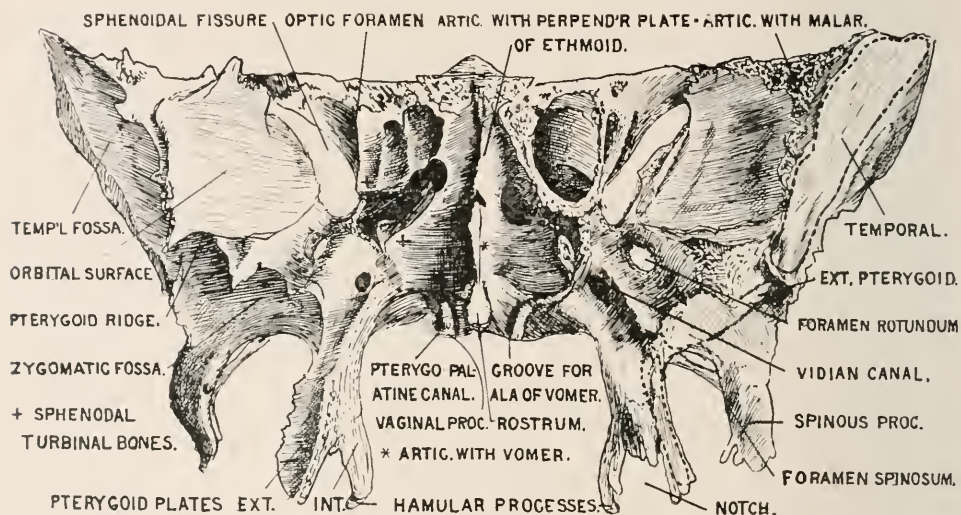


POSTERIOR VIEW OF THE SPHENOID BONE.

ward in the transverse meso-colon where it gives a right branch which anastomoses with the colica-dextra, and a left branch which anastomoses with the colica-sinistra. (C) (Plate CLVII.) The inferior mesentery artery arises from the left side of the aorta about an inch and a half above the bifurcation. It supplies the descending colon, sigmoid flexure, and the greater part of the rectum. It lies at first on the left side of the abdominal aorta, then crosses the Psoas muscle, left common iliac artery, and ureter, to the back of the rectum. It gives off the following branches, COLICA-SINISTRA, which passes behind the peritoneum upward in front of the left kidney to the descending colon where it divides into an ascending branch, which anastomoses with the colica-media, and a descending branch which anastomoses with the sigmoid artery and the superior hæmorrhoidal artery. THE SIGMOID ARTERY passes to the sigmoid flexure and anastomoses with the colica-sinistra and the superior hæmorrhoidal.

THE SUPERIOR HÆMORRHOIDAL ARTERY is really a continuation of the inferior mesenteric artery and passes behind the rectum to divide into two branches in the meso-rectum. One branch passes on either side to within about six inches of the anus where they subdivide to supply the rectum. This artery anastomoses with the sigmoid, middle and inferior hæmorrhoidal arteries. (D) The **suprarenal**, sometimes called MIDDLE CAPSULAR, are two in number and come from the abdominal aorta a little below the cœliac axis. They pass obliquely upward and outward over the crura of the Diaphragm to the suprarenal body. They anastomose with the superior capsular of the phrenic and the inferior capsular of the renal. (E) The **renal arteries** are two in number which come

PLATE CCXLIV.

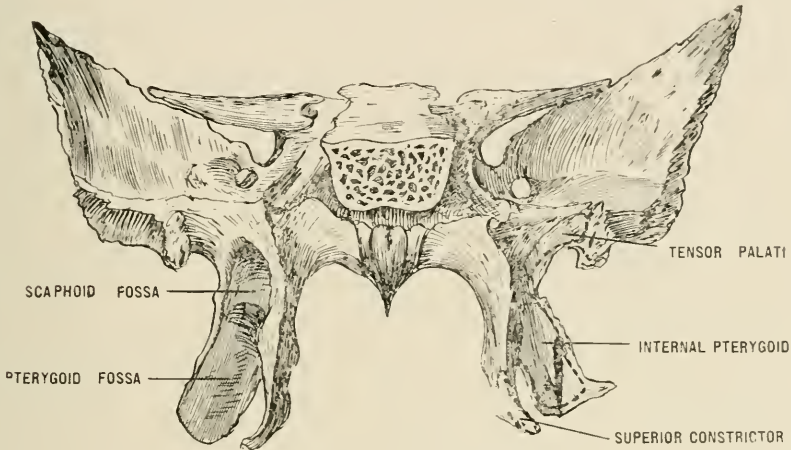


ANTERIOR VIEW OF SPHENOID BONE.

from the abdominal aorta about a half an inch below the superior mesenteric. The one on the right side is a little lower than the one on the left side because the kidney is a little lower. Each passes outward to supply the kidney. The right one passing behind the inferior vena cava. As they enter the kidney each divides into four or five branches. A plexus of nerves accompany this artery. It supplies branches to the suprarenal body, ureter, and the surrounding fat and muscles. Sometimes there is a second renal artery. At the hilum of the kidney the position of the structures from before backward are vein, artery, and ureter. (F) The **spermatic arteries** are two small arteries which arise just below the renal arteries from the abdominal aorta. They pass downward and outward behind the peritoneum but over the Psoas magnus muscle and ureter and external iliac artery, the one on the right side also crosses the inferior vena cava to the internal abdominal ring. Here they pass with the spermatic veins and spermatic plexuses and vas deferens through the inguinal canal to pass out the external abdominal ring into the scrotum where it sup-

plies the testicle. Each artery anastomoses with the artery of the vas deferens and the cremasteric artery. In the female these arteries are called THE OVARIAN. They are shorter than the spermatic and do not pass out of the abdominal cavity. They run between the layers of the broad ligament of the uterus to the ovary and the round ligament and Fallopian tubes. Branches are given off which follow the round ligament through the inguinal canal to the integument of the labium and groin.

PLATE CCXLV.



THE PTERYGOID PROCESSES.

LESSON CXLIV.

MUSCLES OF THE THORAX.

External intercostals.—DESCRIPTION.—There are eleven of these on each side, extending from the tubercles of the ribs posteriorly to the commencement of the cartilages of the ribs anteriorly. From the anterior extremity of the muscle the anterior intercostal membrane extends forward to the sternum. The fibers of the External intercostals pass downward and forward like the fibers of the External oblique muscle of the abdomen. A firm layer of fascia covers the outer surface of the External intercostal as well as the inner surface of the Internal intercostal muscles. The middle intercostal fascia, which is more delicate than either of the others, is placed between the two sets of muscles. The Intercostal fasciæ are best shown between the External intercostal muscles and the sternum anteriorly and between the Internal intercostals and the spine posteriorly, for in these situations the muscular fibers are deficient.

ORIGIN.—From the lower border of each rib extending from the tubercles to the commencement of the cartilages.

INSERTION.—Into the upper border of the rib below extending to the cartilages in the two lower spaces, but in the upper two or three not quite so far.

ACTION.—To raise the ribs so as to increase the capacity of the chest.

NERVE SUPPLY.—Intercostal nerves.

BLOOD SUPPLY.—Intercostal arteries.

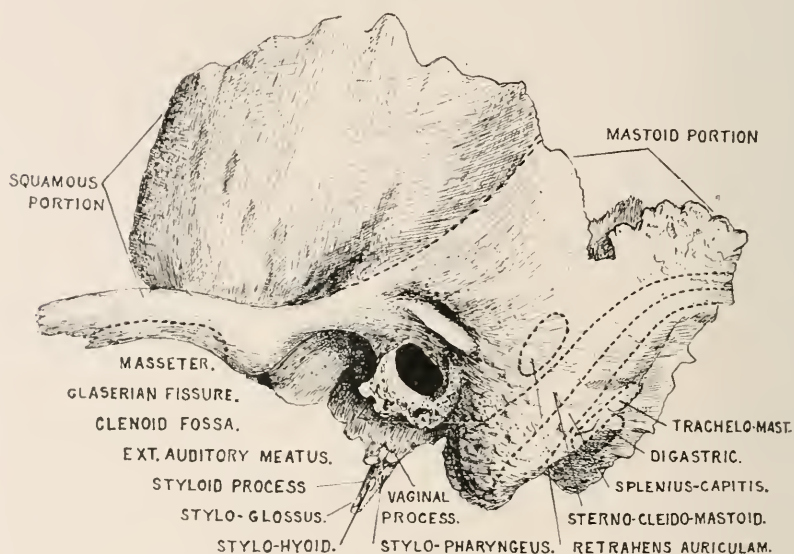
Internal intercostals.—**DESCRIPTION.**—These are eleven in number. Their fibers pass obliquely downward and backward in the opposite direction to those of the External intercostals. They extend from the sternum anteriorly to the angles of the ribs posteriorly.

ORIGIN.—From the inner surface of each rib and the costal cartilage.

INSERTION.—Into the upper border of the rib below.

ACTION.—To depress the ribs and diminish the thoracic cavity. At the front of the chest the Internal intercostal muscles help the External intercostal muscles in raising the cartilages.

PLATE CCXLVI.



THE EXTERNAL SURFACE OF TEMPORAL BONE.

NERVE SUPPLY.—Intercostal nerves.

BLOOD SUPPLY.—Intercostal arteries.

Infracostals, also called **Subcostals**.—**DESCRIPTION.**—These muscles vary in their size and number and are placed on the inner surface of the ribs where the Internal intercostals cease.

ORIGIN.—From the inner surface of the rib.

INSERTION.—Into the inner surfaces of the first, second or third rib below. Their direction is like that of the Internal intercostals. They are more often present between the lower ribs than between the upper ribs.

ACTION.—Depress ribs.

NERVE SUPPLY.—Intercostal nerves.

BLOOD SUPPLY.—Intercostal arteries.

Triangularis sterni.—**DESCRIPTION.**—This muscle is situated upon the inner wall of the chest anteriorly and consists of thin muscular and tendinous fibers.

The attachment of this muscle varies not only in different bodies but on the opposite side of the same body. The superior fibers pass vertically, its middle fibers obliquely outward, and its lower fibers horizontally.

ORIGIN.—From the posterior surface of the ensiform cartilage and the posterior surfaces of the sternal end of the costal cartilages of the three or four lower true ribs, and also from the lower one-third of the posterior surface of the sternum.

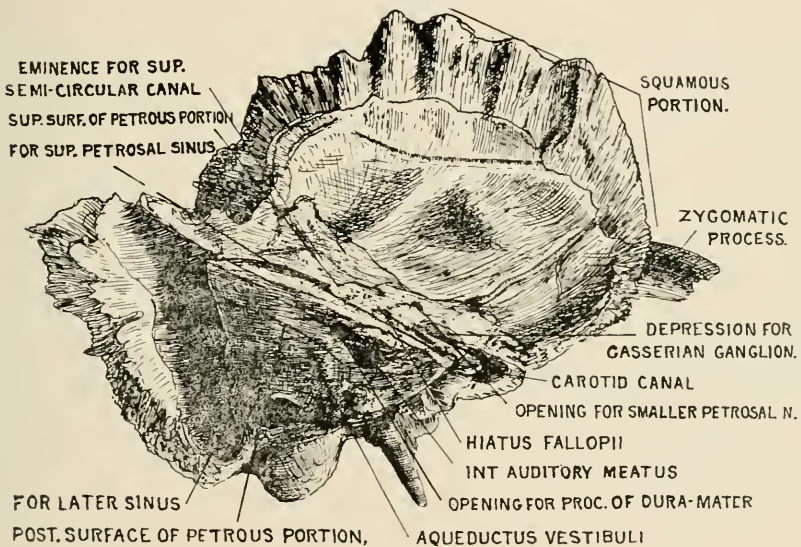
INSERTION.—Into the inner surface and lower border of the costal cartilages of the second, third, fourth, and fifth ribs.

ACTION.—Muscle of forced expiration.

NERVE SUPPLY.—Intercostal nerves.

BLOOD SUPPLY.—Intercostal arteries.

PLATE CCXLVII.



THE PETROUS PORTION OF THE TEMPORAL BONE.

Levatores costarum.—**DESCRIPTION.**—These muscles are situated between the transverse processes of the seventh cervical vertebra and the eleven upper dorsal vertebræ and the border of the first rib below them. There are twelve on each side of the spine.

ORIGIN.—From the ends of the transverse processes of the seventh cervical and the eleven upper dorsal vertebræ. Their direction is obliquely downward and outward.

INSERTION.—Into the upper border of the first rib below between the tubercle and angle. In the lower Levatores costarum muscles there is a second insertion to the second rib below its origin, thus where this is true each rib receives fibers from the transverse processes of the two vertebræ.

ACTION.—Muscle of inspiration.

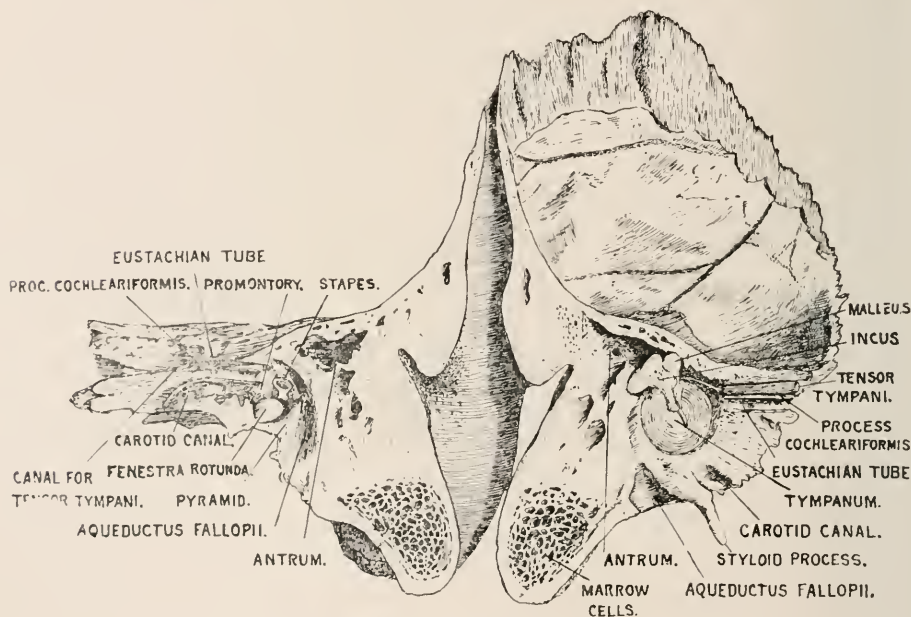
NERVE SUPPLY.—Intercostal nerves.

BLOOD SUPPLY.—Intercostal arteries.

LESSON CXLV.

The **mediastinum** is the space in the thorax which contains all the thoracic viscera except the lungs. This word comes from two other words—medius, the middle, and sto, I stand. The **anterior mediastinum** is the space between the sternum anteriorly and the pericardium posteriorly. It contains the Triangularis sterni muscle, parts of other muscles, lymphatic nodes, and areolar tissue. The **middle mediastinum** is the space which is nearly the same as the pericardiac cavity. It contains the heart, the ascending aorta, pulmonary artery, and the superior vena cava, i.e., the parts of these which are within the pericardium. It also has the phrenic nerves, the root of each lung, and lymphatic nodes. The **posterior mediastinum** is the space between the spine pos-

PLATE CCXLVIII.



THE TEMPORAL BONE LAID OPEN.

teriorly and the pericardium anteriorly. It contains the descending aorta, the azygos veins the thoracic duct, the œsophagus, pneumogastric nerves, and the splanchnic nerves. The **superior mediastinum** is the space which has in front the upper part of the sternum and the spine behind. It is situated above the pericardium and contains all the forty structures which pass through the superior opening in the thorax except the apices of the lungs and the pleuræ. For structures which pass through the superior opening in the thorax see page 232.

Name and classify these forty structures.

LESSON CXLVI.

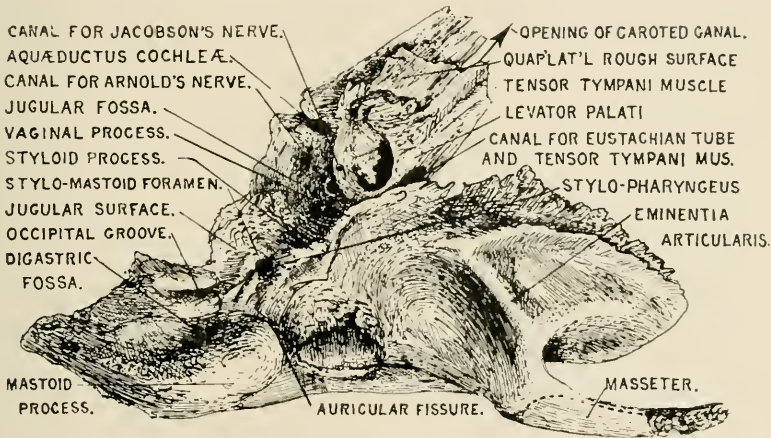
MUSCLES OF THE SUPERFICIAL ABDOMINAL REGION.

Obliquus externus also called Descending oblique.—DESCRIPTION.—This

muscle is the most superficial and the largest muscle in the superficial abdominal region. It is situated on the side and front part of the abdomen. The side of the muscle consists of muscular fibers and its anterior part of aponeurotic fibers. The aponeurosis of this muscle is strong but thin, and its fibers pass obliquely downward and inward. At the linea alba, or median line of the abdomen, it joins the aponeurosis of its fellow. It is connected to the lower border of the Pectoralis major above and below its attachment extends from the anterior superior spine of the ilium to the spine of the os pubes and the ilio-pectineal line, thus forming Poupart's ligament.

ORIGIN.—From the external surface and the lower borders of the eight lower ribs. The attachment of the digitations run downward and backward. The first five of these digitations, which increase in size from above downward,

PLATE CCXLIX.



THE INFERIOR SURFACE OF PETROUS PORTION OF TEMPORAL BONE.

are received between the corresponding processes of the Serratus magnus muscle, while the last three digitations which diminish in size from above downward interdigitate with processes of the Latissimus dorsi muscle.

INSERTION.—Into the anterior half of the outer lip of the crest of the ilium, and into the aponeurosis of the muscle extending from the prominence of the ninth costal cartilage to the anterior superior spinous process of the ilium.

ACTION.—To compress the viscera. To flex the thorax on the pelvis or to flex the pelvis on the thorax. These muscles of the abdominal wall assist in micturition, defecation, and parturition.

NERVE SUPPLY.—Lower intercostals.

BLOOD SUPPLY.—Intercostal and lumbar arteries.

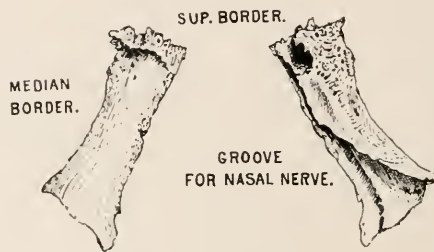
Obliquus internus, also called Ascending oblique.—**DESCRIPTION.**—This muscle lies beneath the External oblique and is smaller and thinner than that muscle.

ORIGIN.—From the outer half of Poupart's ligament, from the anterior

two-thirds of the middle lip of the crest of the ilium, and from the posterior layer of the lumbar fascia.

INSERTION.—Those fibers which arise from Poupart's ligament arch downward and inward over the spermatic cord in the male and the round ligament in the female, and are inserted with fibers of the Transversalis muscle into the crest of the os pubes and the pectineal line to the extent of half an inch. The conjoined tendon is formed by the joining of the Internal oblique muscle and the Transversalis just spoken of. The part of the muscle which arises from the anterior one-third of the middle lip of the crest of the ilium, passes horizontally and at the linea semilunaris it divides sending the lower one-fourth of its aponeurosis in front of the Rectus muscle to be inserted into the linea alba, while the upper three-fourths sends a layer of fascia in front of the Rectus muscle to be inserted into the linea alba and a posterior layer to pass behind the sheath of the Rectus muscle to be inserted into the linea alba also into the seventh, eighth, and ninth ribs. That part of the muscle which passes obliquely upward is inserted in the lower border of the cartilages of the three lower ribs

PLATE CCL.



THE NASAL BONE.

where it is continuous with the Internal intercostal muscles. The outer layer of the conjoined tendon is called the ligament of Hesselback, while the inner layer is called the ligament of Henle.

ACTION.—Same as External oblique.

NERVE SUPPLY.—Lower intercostals, ilio-hypogastric, and sometimes the ilio-inguinal.

BLOOD SUPPLY.—Intercostal and lumbar arteries.

LESSON CXLVII.

Transversalis.—**DESCRIPTION.**—This muscle which is placed beneath the Internal oblique takes its name from the direction of its fibers.

ORIGIN.—From outer one-third of Poupart's ligament, anterior three-fourths of the inner lip of the crest of the ilium, and inner surface of the cartilages of the lower six ribs, interdigitating with the Diaphragm. It also comes from the lumbar fascia.

INSERTION.—This muscle ends in a broad aponeurosis the lower part of which joins the Internal oblique forming the conjoined tendon. The remain-

ing part of the aponeurosis passes horizontally towards the linea alba, but at the linea semilunaris it passes behind the Rectus muscle blending with the posterior layer of the Internal oblique.

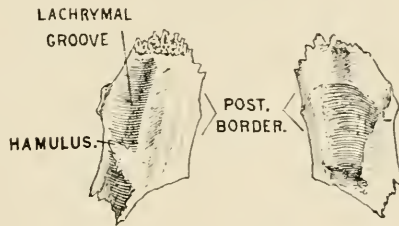
ACTION.—Same as the External oblique.

NERVE SUPPLY.—Intercostal, ilio-hypogastric, and sometimes the ilio-inguinal.

BLOOD SUPPLY.—Intercostal and lumbar arteries.

Rectus abdominis.—**DESCRIPTION.**—This muscle extends from the symphysis pubes to the sternum. It is much broader and thinner above than below and is separated from its fellow by the linea alba. The lineæ transversæ are tendinous intersections which cross this muscle. There are three such lines. One is situated opposite the umbilicus and one at the extremity of the ensiform cartilage, and a third one between these two. Occasionally one or two additional lines may be seen. These lines are homologues of ribs. The sheath of the Rectus muscle contains the Pyramidalis muscle and the superior epigastric artery, the deep epigastric artery, and the terminal branches of the lower intercostal and lumbar arteries and nerves.

PLATE CCLI.



THE LACHRYMAL BONE.

ORIGIN.—By two heads, (1) the external or larger head being attached to the crest of the os pubes. (2) the internal one is connected with the ligaments covering the symphysis and interlacing with its fellow of the opposite side.

INSERTION.—Into the cartilages of the fifth, sixth, and seventh ribs, and occasionally connected with the costo-ziphoïd ligaments and side of the ensiform cartilage.

ACTION.—To compress abdominal viscera, and to flex thorax.

NERVE SUPPLY.—Lower intercostals.

BLOOD SUPPLY.—Intercostal, lumbar, deep epigastric and superior epigastric arteries.

Pyramidalis.—**DESCRIPTION.**—This muscle is situated in the same sheath with the Rectus abdominis muscle in front of the lower portion of that muscle. It may be absent on one or both sides, or it may be double on one side.

ORIGIN.—From front of pubic bone and anterior pubic ligament.

INSERTION.—Into the linea alba half way to the umbilicus.

ACTION.—To tense linea alba.

NERVE SUPPLY.—Twelfth thoracic and ilio-hypogastric.

BLOOD SUPPLY.—By arteries in the sheath of the Rectus.

Cremaster.—**DESCRIPTION.**—This muscle, which consists of thin muscular fasciculi which are continuous with those of the Internal oblique and some times with those of the Transversalis, descends through the external abdominal ring from the front of the spermatic cord.

ORIGIN.—From the middle of Poupart's ligament.

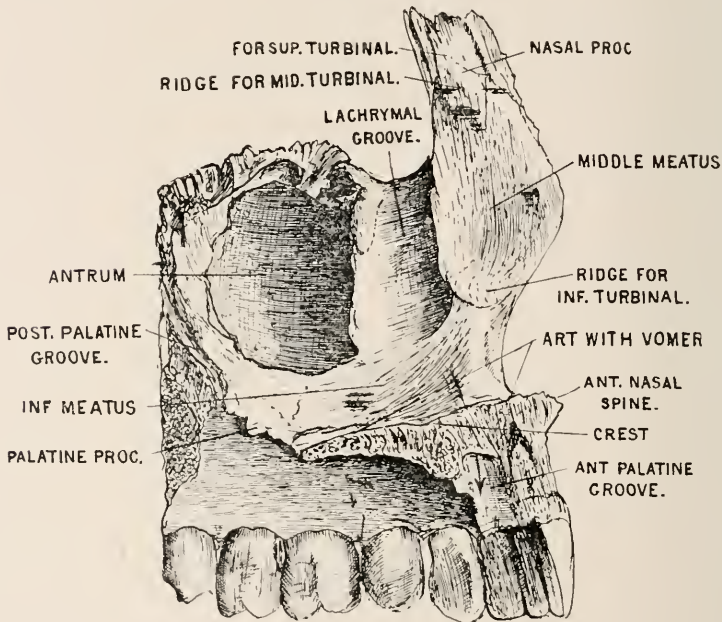
INSERTION.—Into the crest of the os pubis and sheath of the Rectus.

ACTION.—To retract testicle.

NERVE SUPPLY.—Genital branch of the genito-crural.

BLOOD SUPPLY.—Spermatic artery.

PLATE CCLII.



THE INTERNAL SURFACE OF SUPERIOR MAXILLARY BONE.

The origin and insertion of this muscle is similar to that of the lower fibers of the Internal oblique. This muscle is found in the male, but a few muscular fibers may be seen on the round ligament of the female which correspond to this muscle.

LESSON CXLVIII.

MUSCLES OF DEEP ABDOMINAL REGION.

- (1) **Psoas parvus** which has been described on page 134.
- (2) **Psoas magnus** which has been described on page 134.
- (3) **Iliacus** which has been described on page 135.
- (4) **Quadratus lumborum.**—**DESCRIPTION.**—This muscle is situated in a sheath formed by the anterior and middle layers of the lumbar fascia. On the

anterior surface of this muscle beneath this fascia are the last dorsal, ilio-hypogastric, and ilio-inguinal nerves. The middle layer of the lumbar fascia separates this muscle from the Erector spinæ. This muscle as its name implies is quadrilateral, broader below than above.

ORIGIN.—From the ilio-lumbar ligament and the crest of the ilium for about two inches. Occasionally a second portion of this muscle is found situated in front of the muscle, and when so found it has its origin from the upper borders of the transverse processes of three or four lower lumbar vertebræ and is inserted into the lower margin of the last rib.

INSERTION.—Into the apices of the transverse processes of the four upper lumbar vertebræ and into the lower border of the last rib for about half its length.

ACTION.—To draw down the last rib and acts as a muscle of inspiration.

NERVE SUPPLY.—Last dorsal, first and occasionally the second lumbar.

BLOOD SUPPLY.—Intercostal and lumbar arteries.

LESSON CXLIX

The **word membrane** is used to name any thin expansion of tissue, and has the following classes: (1) **SEROUS MEMBRANE**, which is the simplest of all forms. These serous membranes derive their name from the fact that they are moist with a fluid like blood-serum. The serous membranes are closed sacs, such as the pericardium, pleura, and peritoneum. However, the peritoneum in the female is an open sac. (2) **SYNOVIAL MEMBRANE** which lines the joints. This membrane secretes synovia, which resembles the white of egg. Under synovial membrane we have three classes, (a) articular, which occurs in joints, (b) vaginal, which is found where the tendons of muscles run over bones, (c) bursal. A synovial bursa is a bag which is lined with synovial membrane and placed between the tendon of a muscle and a bone, or two muscles, or two tendons. (3) **MUCOUS MEMBRANE**. The mucous membrane lines open cavities. (4) **CUTANEOUS MEMBRANE**, which is commonly called skin.

The **peritoneum** is a serous membrane with a smooth shining surface. This membrane is transparent, uncolored, strong, and moist. The peritoneum is reflected from the abdominal walls and from pelvic walls over the viscera to invest and at the same time hold them in position. The part which lines the abdominal and pelvic wall is called **PARIETAL OR EXTERNAL PERITONEUM**, and that which invests the viscera, to a greater or less extent, is called the **VISCERAL OR INTERNAL PERITONEUM**. If it were possible to separate the entire peritoneum from the body, it would be in the form of a **LARGE CLOSED SAC** with a constriction a little above its center, thus forming the greater and lesser sacs of the peritoneum. The passage way between these two sacs is called **THE FORAMEN OF WINSLOW**. The foramen of Winslow has **ABOVE** it the caudate lobe of the liver, **IN FRONT OF** it the lesser omentum, **BELOW** it the duodenum, and hepatic vessels, **BEHIND** it the inferior vena cava. The lesser sac of the peritoneum lies back of and below the stomach and liver, while the greater sac lies in front and below these viscera.

The **peritoneum** (literal meaning is stretched around) in the male forms a closed sac. In the female it forms an open sac by means of the two Fallopian tubes. It has an outer or parietal layer and an inner or visceral layer. It lines most of the viscera of the abdominal cavity and in its development forms folds and ligaments. The lesser sac is in the **greater omentum** but the greater sac is **not** in the lesser omentum. A fold of peritoneum going from the abdominal wall to the small intestine is called **the mesentery**. A fold of peritoneum going from the lesser curvature of the stomach to the transverse fissure of the liver is called the **lesser omentum** and a fold of peritoneum going from the greater curvature of the stomach to the transverse colon is called the **greater omentum**.

The **greater omentum** has four layers in it which cannot be demonstrated in the adult but can be in the fetus. The **lesser omentum** has two folds in it. A fold of peritoneum passing from the liver to the spleen is called gastro-splenic omentum. All other folds of peritoneum are called **ligaments**.

The following **eleven structures** are entirely covered with peritoneum: (1) Spleen, (2) liver, (3) stomach, (4) first portion of the duodenum, (5) small intestine, (6) caecum, (7) transverse colon, (8) sigmoid flexure, (9) first portion of the rectum, (10) ovaries, and (11) the uterus.

The following **six structures** are entirely stripped of peritoneum, (1) pancreas, (2) kidney, (3) suprarenal capsule, (4) third portion of the rectum, (5) anterior portion of the bladder, and (6) lower portion of the vagina.

Tracing **the greater sac**, (Plate CLI.) starting at the umbilicus and descending, it covers the anterior abdominal wall, reflected over the symphysis pubis, over the posterior portion of the bladder, over the uterus and the anterior surface of the rectum, forming a pouch called the pouch of Douglas, up the posterior abdominal wall it reaches almost to the pancreas and there it is reflected towards the small intestine forming the posterior layer of **the mesentery**; surrounding the small intestine it passes up to the abdominal wall again, forming the anterior layer of **the mesentery** and there it is reflected over to the transverse colon, forming the posterior layer of the transverse meso-colon; from there it forms the fourth and first layers of the greater omentum, passing up to the stomach and from there over the anterior border of the stomach and continuing up to the transverse fissure of the liver forming the anterior layer of the lesser omentum. From this fissure it continues over the anterior portion of the liver, forming the suspensory ligament of the liver, from there being reflected on the anterior abdominal wall down to the starting point.

The **lesser sac** (Plate CLI) is traced from the posterior surface of the liver, descending and forming the posterior layer of the lesser omentum, being reflected over the posterior surface of the stomach and from there forming the second and third layers of the greater omentum and from there ascending and forming the anterior layer of the transverse meso-colon up to the posterior surface of the liver.

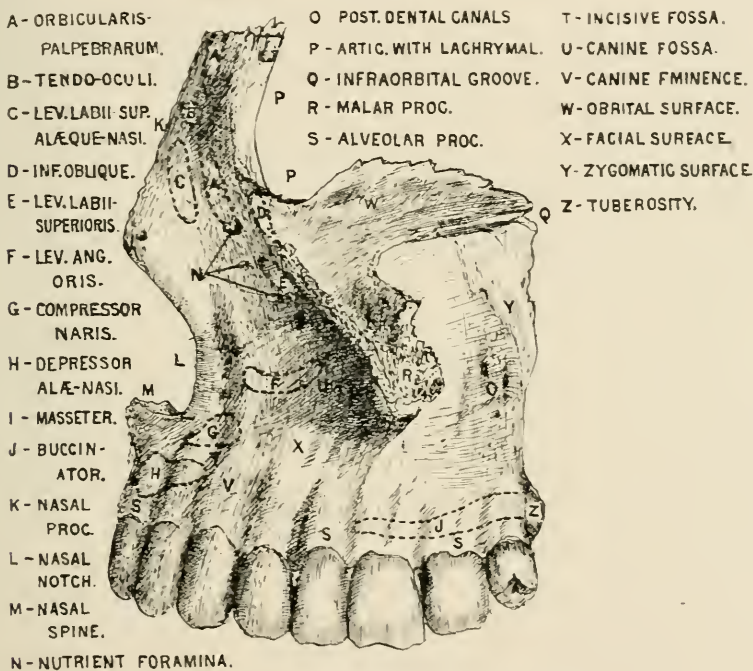
The **peritoneum** can be shown as a closed sac best by a transverse section at the umbilicus. (Plate CL.)

The **functions** of the peritoneum are as follows: (1) It secretes serum which lubricates its adjacent surfaces, (2) it absorbs any excess of its own secretion

as well as foreign material which may be introduced, (3) it is ligatory such as the falciform ligament of the liver, (4) it is pilicate, as the plica epigastrica where it makes a fold over the epigastric artery, (5) it is mesenteric which bind organs to the walls of the abdomen and conducts nutrient nerves and vessels to the organs. The transverse meso-colon is an example of this. (6) It is omental, which means it binds one organ to another. An example the gastro-splenic omentum. An omentum may or may not contain nutrient nerves and vessels.

NERVE SUPPLY.—The parietal peritoneum receives its nerve supply from the sympathetic through the gray rami communicantes. The visceral, peritoneum receives its nerve supply from the solar plexus.

PLATE CCLIII.



EXTERNAL SURFACE OF SUPERIOR MAXILLARY BONE.

BLOOD SUPPLY.—The parietal peritoneum receives its blood supply from the intercostals, phrenic, lumbar, circumflex iliac, and deep epigastric arteries. The visceral peritoneum receives its blood supply from the gastric, hepatic, splenic, renal, and mesentery arteries. These latter arteries nourish organs.

LESSON CL.

The **kidney** (Plate CCLXVI) belongs to the urinary system, which has but one function, that of elimination, while the alimentary system has two functions, appropriation and elimination. The kidney is bean-shaped and is situated between the spinous processes of the eleventh dorsal and the third

lumbar. The right kidney is a little lower than the left one on account of the liver being above the kidney on the right side. The **scar**, or the point where the vessels enter and leave the kidney is on the inner border, about its middle. Its vessels bear this relation to one another, the **renal vein, renal artery**, and the **ureter**, from before backward. The kidney is entirely stripped of peritoneum. It has above and in front of it the suprarenal capsule which has something to do with the pigmentation of the body and is considered by some as belonging to the sympathetic nervous system. The **kidney** has the following dimensions, four and three-fourths by two and one-half by one and three-fourths inches. It **weighs** from four to six ounces. Its **NERVE SUPPLY** is from the renal plexus which comes from the solar plexus. Its **BLOOD SUPPLY** is the renal, suprarenal, spermatie, and lumbar. The right renal vein contains the purest blood in the body.

The **outer portion** of the kidney is called cortex, while the interior is called medullary portion. The kidney in the fetus and some of the lower animals looks like a bunch of grapes; it is made up of individual lobes; the point where these lobes coalesce entirely disappears in the adult kidney, giving the appearance of one solid body. The **physiologological kidney** consists of the uriniferous tubules. These are about one-half million in number and would be fifteen miles in length if placed end to end. This **uriniferous tubule** consists of (1) a capsule or head, (2) neck, (3) spiral portion, (4) descending portion, (5) loop, (6) ascending portion, (7) distal spiral portion, (8) convoluted portion, (9) irregular portion, (10) arched portion, and (11) a descending portion. (Plate CCLXV.) The capsule, or Malpighian body, takes from the blood the water and lesser salts, while the rest of the tube takes the more important salts from the blood. The **medullary portion** of the kidney consists of Malpighian pyramids, eighteen or twenty in number, with the apex towards the hilum of the kidney. The **apex** consists of infundibula, and the infundibula make the calices, the calices form the pelvis and the pelvis opens into the ureter. Between these pyramids is cortex, the same as the cortex of the outer portion of the kidney, but has a special name, called the **COLUMN OF BERTIN**. That part of the uriniferous tubules consisting of a straight portion and the two spiral portions form what is called the **MEDULLARY RAY**, or the **PYRAMIDS OF FERREIN**, the base of the pyramid is on the base of the Malpighian pyramid and the apex is towards the periphery. The uriniferous tubules in the cortex form what is called the **LABYRINTH**.

THE RELATIONS OF THE RIGHT KIDNEY.

ABOVE.—Suprarenal capsule.

IN FRONT.—(1) Suprarenal capsule, (2) Liver, (3) Duodenum, (4) Ascending colon, (5) Jejunum-ileum.

BEHIND.—(1) The last rib, (2) Diaphragm, (3) Quadratus lumborum, (4) Psoas magnus. (Plate VIII.)

THE RELATIONS OF THE LEFT KIDNEY.

ABOVE.—Suprarenal capsule.

IN FRONT.—(1) Suprarenal capsule, (2) Spleen, (3) Stomach, (4) Pancreas, (5) Splenic flexure, (6) Descending colon, (7) Jejunum-ileum.

BEHIND.—(1) The last rib, (2) Diaphragm, (3) *Quadratus lumborum*, (4) *Psoas magnus*. (Plate VIII.)

The **organs of the urinary system** are, (1) the two kidneys, which form the urine from the materials furnished by the blood; (2) the ureters, which convey the urine away from the kidneys; (3) the bladder in which the urine is stored until it is discharged, and (4) the urethra, a tube through which the urine passes from the bladder.

The **kidney** is a glandular structure whose function is the purification of the blood by the excretion of the urine. It is held in position by its vessels, the peritoneum and the abundant fatty tissue. This fatty tissue forms the "adipose capsule."

The **hilum of the kidney** is the place on the median side of the kidney, corresponding to the place of the scar on the bean. It is where the ureter goes out and the vessels and nerves enter. The capsule of the kidney is a smooth fibrous membrane closely investing the kidney and forming its outer coat.

Floating kidney is one which has become loose and displaced in the abdomen. Surgical kidney is a term somewhat loosely applied to nephritic conditions, secondary conditions to mischief farther down in the urinary tract, but especially to suppurative pyelonephritis arising from cystitis.

The **pelvis** or **sinus of the kidney** is the concavity or re-entrance at the hilum of the kidney. The calices of the kidney are cup-like or infundibuliform beginnings of the ureter in the pelvis of the kidney surrounding the apices of the Malpighian pyramids, each usually receiving more than one pyramid. There are from seven to thirteen such calices, converging and uniting in the infundibula, which in turn combine to form the pelvis. The infundibula of the kidney are, (a) the calices; (b) the two or three main divisions of the pelvis of the kidney formed by the confluence of the calices.

The **apices** of the Malpighian pyramids, also called *mamillæ*, are the *papillæ* of the kidney. The **Malpighian pyramids** are pale-reddish conical masses forming the medullary part of the kidney, whose apices project into the calices of the pelvis of the kidney, and are called *papillæ*. The Malpighian corpuscles or bodies are the glomeruli of the kidney surrounded by its capsule. These form the terminations of the branches of the uriniferous tubules, occur in the cortical substance of the kidney, and are about $\frac{1}{1000}$ of an inch in diameter. They are formed of the expanded end of the tube invaginated by the bunch of blood vessels constituting the glomerulus which thus are embraced in a double epithelial sac, and the blood is separated from the lumen of the tubule by the vascular wall and the epithelium of the inner layer of the capsule.

The **Malpighian tuft** is the glomerulus or vascular network or plexus in a Malpighian body. Marcello Malpighi (1628-94) was an Italian anatomist and physiologist.

The **cortical substance** of the kidney is the outer part of the kidney substance which contains the glomeruli. The columns of Bertin are named after E. F. Bertin, a French anatomist (1712-81). They are the prolongations inward of the cortical substance of the kidney between the pyramids.

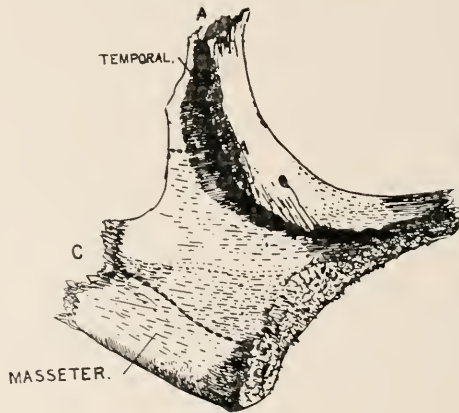
The **tubes of Ferrein** make the pyramids of Ferrein. They are in help to the cortical substance and are convoluted. The pyramids of Ferrein are formed by bundles of straight and convoluted renal tubules which constitute the **medullary rays**, so named on account of their radiation from the medulla.

The **tubes of Bellini** are the excretory tubes opening on the papilla. They are straight tubes.

The **tubes of Henle** connect those of Bellini and Ferrein. They are looped tubes.

The **capsule of Muller** is the dilated extremity of a tube of Ferrein investing the Malpighian tuft probably by two layers, similar to the pleural investment of the lungs.

PLATE CCLIV.



INTERNAL SURFACE OF THE MALAR BONE.

The **NERVE SUPPLY** to the kidney is from the renal plexus which is formed by filaments from the solar plexus and the lesser splanchnic nerve.

The **BLOOD SUPPLY** is from the renal artery and renal vein. (a) Afferent (vessels carrying to), (b) efferent vessels (carrying from). The kidney is very vascular. The larger arterial branches run up between the pyramids of Malpighi to subdivide at their bases into cortico-medullary arches which lie between the cortex and medulla, giving off arterioles in both directions, the cortical branches supplying afferent twigs to the glomeruli within the capsules of Bowman.

The medullary branches running inwards to form plexuses around the straight and looped tubules of the Malpighian pyramids. The efferent vessels of the Malpighian glomeruli form a capillary plexus around the uriniferous tubules and terminate in renal veins.

The **surface of the kidney** receives small arteries which pass through the fatty capsule from the suprarenal, spermatic, and lumbar vessels. The superficial veins appear in the form of little stellate groups (stars of Verhagen) which

communicate with the venous plexus in the adipose capsule and by means of this with the visceral and parietal veins close by. These veins are very distinct when the organ is congested.

The **renal lymphatics** may be divided into two sets, capsular and parenchymatous. They terminate in a series of glands lying with the renal vessels in the subperitoneal tissue, and their contents are ultimately conveyed into the receptaculum chyli.

LESSON CLI.

The **ureter** (Plate VIII.) is a tube conveying the urine from the kidney to the bladder in mammals, or into the cloaca in case no bladder exists. The human ureter is a slender tube from fifteen to eighteen inches long running from the pelvis of the kidney to the base of the bladder, at the posterior angle of the trigonum. It is behind the peritoneum and rests upon the Psoas muscle.

Its structure includes (1) a fibrous coat, (2) longitudinal and circular muscular fibers, and (3) a lining of mucous membrane with vessels and nerves from various sources. The ureter pierces the wall of the bladder very obliquely. It runs for nearly an inch behind the muscular and mucous coats of the bladder.

BLOOD SUPPLY.—(1) The renal, (2) Spermatic, (3) Internal iliac, and (4) Inferior vesical.

NERVE SUPPLY.—(1) Inferior mesenteric, (2) Spermatic plexus, (3) Pelvic plexus.

The **bladder** is the reservoir in which the urine is collected from the ureters. It has four coats, (1) the mucous, which is nearest the cavity, (2) the areolar, (3) the muscular, and (4) the serous. The trigonum is a triangular space or area at the base of the bladder, whose apex is at the beginning of the urethra, and whose other two angles are at the point of entrance of the ureters into the bladder.

When the bladder is collapsed its mucous walls fall together in such a way that a sagittal section shows the line between them in the shape of a V with unequal and widely spread arms, the point of the V indicating the opening of the urethra. Its dimensions are three by five inches. Its capacity is about a pint. In the child the bladder is almost an abdominal organ, while in the adult it is in the pelvis.

The **urachus** is a fibrous cord extending from the fundus of the bladder to the umbilicus. It represents in the adult a part of the sac of the allantois and associate allantoic vessels of the fetus, whose cavities have been obliterated. It is that intra-abdominal section of the navel-string which is constituted by so much of the allantoic sac and hypogastric arteries as becomes impervious, the section remaining pervious being the bladder and superior vesical arteries. It sometimes remains pervious, as a malformation, when the child may urinate by the navel.

The **allantois** is a fetal appendage of most vertebrates, developing as a sac or diverticulum from the posterior portion of the intestinal cavity. It is one of the organs of the embryo of all amniotic vertebrates, or those which develop an amnion, but is wanting or is most rudimentary in amphibians and fishes. In birds and reptiles it is large and performs a respiratory function, and in mammals contributes to form the umbilical cord and placenta. Its exterior primitively consists of mesoblast, its cavity receiving the secretion of the primordial kidneys (Wolffian bodies). So much of the sac as remains pervious within the body of the embryo becomes the urinary bladder, or in some degree a urinary passage.

The **umbilical arteries and veins** course along the elongated stalk of the sac, which becomes the umbilical cord, and that part of these allantoic vessels within the body which does not remain pervious become the urachus and round ligament of the liver.

The expanded extremity of the allantois, in most mammals, unites with the chorion to form the placenta. In those vertebrates, as mammals, in which the umbilical vesicle has but a short period of activity, the allantois chiefly sustains the functions whereby the fetus is nourished by the blood of the mother and has its own blood arterialized. In parturition, so much of the allantois as is outside of the body of the fetus is cast off, the separation taking place at the navel.

The **uvula vesicae** is a slight projection of mucous membrane from the bladder into the cystic orifice of the urethra.

The **arteries of the bladder** are the superior, middle and inferior vesical and in the female the uterine and vaginal also; its veins are radicles of the internal iliac. The lymphatics accompany the veins and terminate in the internal iliac gland. The nerves are derived partly from the sympathetic system through the hypogastric plexuses, partly from the cerebro-spinal system through the third and fourth sacral nerves. The former supply the mucosa, the latter of the muscularis.

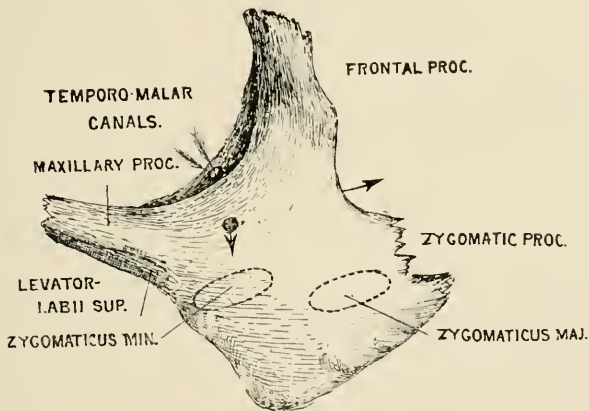
The **bladder** is held in place by ligaments which are divided into true and false. THE TRUE LIGAMENTS are five in number; the two anterior, two lateral, and the urachus (superior). THE FALSE LIGAMENTS, also five in number, are formed by folds of the peritoneum. The false are named the two posterior, two lateral and superior.

LESSON CLII,

The word **urethra** (Plates CCLXXII-CCLXXIX) is derived from the Greek which means to urinate. The male and female urethrae differ. It is a modification of a part of a uro-genital sinus into a tube or a groove for the discharge of the secretion of the genital or urinary organs or both; in most mammals, including man, a complete tube from the bladder to the exterior, conveying urine and semen in the male sex, urine only in the female; in some birds a penial groove for the conveyance of semen only. The urethra in the male is always a part of the penis, or penial urethra, continuous usually with the urethral part

of the uro-genital sinus; that of the female is only exceptionally a part of the clitoris. In **man** the urethra extends from the bladder to the end of the penis, usually a distance of eight or nine inches. The male urethra has three portions—the prostatic, the membranous, the spongy—the structures and the relations of which are essentially different. Except during the passage of the urine or semen the urethra is a mere transverse cleft or slit with its upper and under surfaces in contact. At the orifice of the urethra, at the end of the penis, the slit is vertical and in the prostatic portion somewhat arched. The prostatic portion is one and one-fourth inches long, THE MEMBRANOUS three-fourths of an inch long, and THE SPONGY four and one-half inches long. The first and second portions are not subject to any physiological changes such as characterize the third.

PLATE CCLV.



EXTERNAL SURFACE OF MALAR BONE.

The **urethra** has three coats, mucous, muscular, and erectile. The bulb of the urethra is the posterior enlarged rounded extremity of the corpus spongiosum of the penis.

The **crista urethra** is the crest of the urethra; a longitudinal fold of mucous membrane and subadjacent tissue on the median line of the floor of the prostatic urethra, about three-fourths of an inch in length and one-fourth of an inch in height where it is greatest. On the summit open the ejaculatory ducts. It is also called *colliculus seminalis*, *caput galliaginis*, and *verumontanum*.

The **prostatic sinus** is a longitudinal groove in the floor of the urethra on each side of the crest, into which the prostatic ducts open.

The **pocularis sinus** is a small cul-de-sac, from a quarter to half an inch in its greatest diameter, situated at the middle of the highest part of the crest of the urethra. It corresponds with the uterus of the female. Also called prostatic vesicle, utricule, uterus masculinus. The semilunar ducts open on the margins of the sinus pocularis.

Cowper's glands (Plate CCLXXIX) are a pair of accessory prostatic or urethral glands of lobulated or follicular structure which pour a mucous secrete-

tion into the urethra. In man they are small, about the size of a pea, lying beneath the membranous portion of the urethra, close behind the bulb and emptying into the bulbous portion of the tract. Their size, shape, and position vary in different animals, in some of which they are much more highly developed than in man.

The **fossa navicularis** is (a) a recess in the urethra, near the urinary meatus, where the caliber of the tube is enlarged. (b) A depressed space between the posterior commissure of the vulva and the fourchette.

The **lacuna magna** is the largest of several orifices of mucous follicles, situated on the roof of the fossa navicularis.

The **glands of Littre** are the crypts along the spongy portion of the urethra.

The **prostate** ("standing in front") is a glandular body situated around the initial portion of the urethra. It develops at puberty, atrophies after castration, and in certain animals increases in size during the breeding season.

The **female urethra** is a tube beginning at the meatus urinarius internus in the bladder and ends at the meatus urinarius externus in the vulva. It is about one and one-half inches long, imbedded in the anterior wall of the vagina, perforating the triangular ligament, and surrounded by the fibers of the Compressor urethrae muscle. Its diameter is about one-fourth inch, but it is capable of considerable dilatation, being surrounded by softer structures than those around the male urethra. When dilated far beyond its usual calibre it does not lose its tone.

LESSON CLIII.

The **literal meaning** of hernia is branch. It is a tumor formed by the displacement and protrusion of a part which has escaped from its natural cavity by some aperture and projects externally. It is sometimes called rupture. We may have hernia of the brain and of the coverings of the cord, of the thorax, or of the abdomen. When we speak of hernia without any qualification, we mean hernia of the abdomen, and this is the most common form, consisting of the protrusion of some part of the viscera through a natural or accidental aperture in the inner wall of the abdomen, the external skin generally remaining unbroken. The following are some of the forms of hernia:

1. **CEREBRAL HERNIA**, which is a protrusion of the brain through an opening in the cranial walls.
2. **CRURAL HERNIA** or **FEMORAL HERNIA** is a hernia descending beside the femoral vessels.
3. **DIRECT INGUINAL HERNIA** is a hernia of the intestine or omentum which descends through the inguinal canal; but not through the internal abdominal ring having broken into the canal below this ring in Hesselbach's triangle.
4. **THE INDIRECT or OBLIQUE INGUINAL HERNIA** is a hernia whose course is that of the spermatic cord through the inguinal canal.
5. **LUMBAR HERNIA** is a hernia in the loins or lumbar region.
6. **PHRENIC HERNIA** is a hernia projecting through the Diaphragm into one of the pleural cavities.

7. **STRANGULATED HERNIA** is a hernia so tightly compressed in some part of the channel through which it has been protruding as not to be reducible by ordinary means, as by the application of pressure, and to interfere with the circulation in the protruding part.

8. **UMBILICAL HERNIA** is a hernia of the intestine at the navel. It is called *exomphalos*.

THE FOLLOWING ARE THE PRINCIPAL CAUSES OF HERNIA:

1. Tight lacing, because it diminishes the abdominal cavity.
2. Crying and fretting, bronchitis, asthma, cough.
3. Deposit of fat in the omentum because it increases the volume and weight of the parts within.
4. Pregnancies because of the stretching of the abdominal walls.
5. Straining in defecation.
6. Phimosis because of the straining to expell the urine.
7. Feats of strength as in lifting heavy weights.
8. Men have larger inguinal rings, women have a larger femoral arch, so sex has something to do with the kind of hernia.
9. Presence of the spermatic cord.
10. Deficiency of some of the layers below.
11. Persistence of the original process of the peritoneum.
12. A long mesentery.

The **inguinal canal** is parallel to Poupart's ligament and just above it, extending from the internal abdominal ring to the external abdominal ring. It is about an inch and a half long. This is a potential canal, but for a short time in the later months of fetal life it is a real canal. The spermatic cord in the male and the round ligament in the female pass through this canal. Its direction is downward, forward and inward.

THE RELATIONS OF THE INGUINAL CANAL.

IN FRONT.—(1) Skin, (2) Superficial fascia, (3) External oblique muscle for all the way, (4) Internal oblique muscle for the outer third of the canal.

BELOW.—The union of the transversalis fascia with Poupart's ligament.

BEHIND.—(1) The conjoined tendon, (2) Transversalis fascia, (3) Triangular fascia, (4) Subperitoneal tissue, (5) Peritoneum.

ABOVE.—Arched fibers of the Internal oblique and Transversalis muscles.

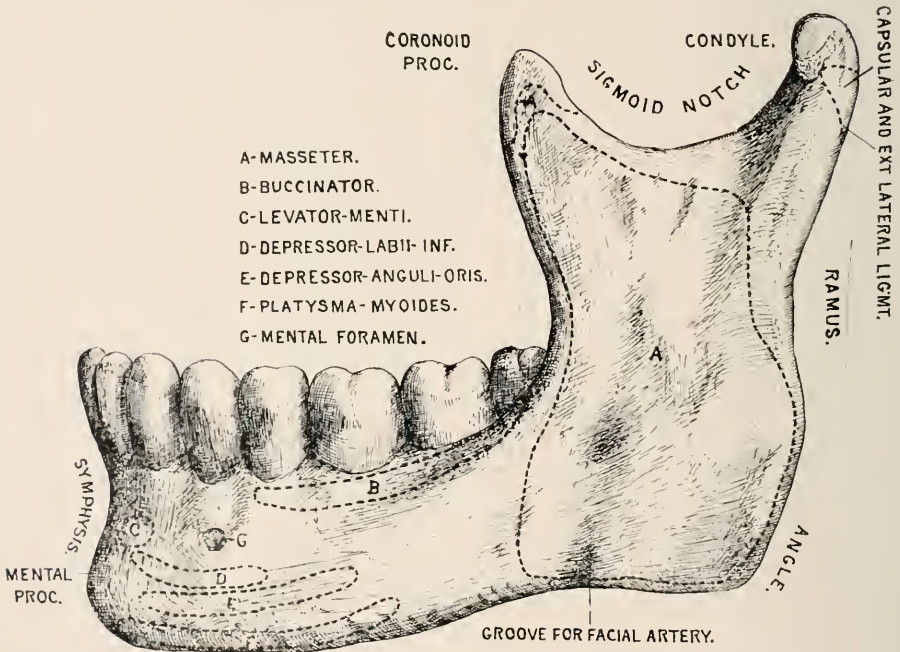
THE COVERINGS OF THE INDIRECT OR OBLIQUE INGUINAL HERNIA FROM WITHIN OUTWARD ARE:

1. Peritoneum, which is the proper hernial sac.
2. Extra-peritoneal fat. This is almost inappreciable.
3. Infundibuliform fascia, which is from the internal abdominal ring.
4. Cremasteric fascia, which is from the inguinal canal.
5. Intercolumnar fascia, which is from the external abdominal ring.
6. Two layers of superficial fascia.
7. Skin.

THE COVERINGS OF THE DIRECT INGUINAL HERNIA FROM WITHIN OUTWARD ARE:

1. Peritoneum.
2. Extra-peritoneal fat.
3. Transversalis fascia.
4. Conjoined tendon, which takes the place of cremasteric fascia in the indirect hernia.
5. Intercolumnar fascia, which takes the place of infundibuliform in the indirect hernia.
6. Two layers of superficial fascia.
7. Skin.

PLATE CCLVI.



EXTERNAL SURFACE OF INFERIOR MAXILLARY BONE.

The **external abdominal ring** (Plate XV) is a potential opening in the aponeurosis of the External oblique muscle which is made by the divergence of two of its fasciculi. The size of this opening varies on account of the strength of its sides or pillars. It is about an inch long and half an inch wide. It is situated above and to the outer side of the crest of the os pubis. The spermatic cord in the male and the round ligament in the female passes through this opening to pass from the abdomen.

THE RELATIONS OF THE EXTERNAL ABDOMINAL RING.

ABOVE.—A series of curved fibers called the intercolumnar.

BELOW.—The crest of the os pubis.

ON EITHER SIDE.—Columns or pillars of the ring.

The **internal abdominal ring** (Plate XV) is situated about half way between the anterior superior spine of the ilium and the symphysis pubis. It is about half an inch above Poupart's ligament and in the transversalis fascia. This is also a potential opening. This is much larger in the male than in the female.

THE RELATIONS OF THE INTERNAL ABDOMINAL RING.

ABOVE AND EXTERNALLY.—Arched fibers of the Transversalis muscle.

BELOW AND INTERNALLY.—Deep epigastric vessels.

The spermatic cord in the male and the round ligament in the female pass through this opening.

Gimbernath's ligament is about a half an inch in length and larger in the male than in the female. In the erect posture it is almost horizontal in direction with its base directed outward, it being triangular in form. It is derived from the External oblique muscle and is reflected downward and outward from the spine of the os pubis to be inserted into the pectineal line. Its anterior margin is continuous with Poupart's ligament.

The **triangular ligament** of the abdomen is attached by its apex to the pectineal line where it is continuous with Gimbernath's ligament. From there it passes inward beneath the spermatic cord behind the inner pillar of the external abdominal ring and in front of the conjoined tendon to the linea alba where it joins its fellow.

Poupart's ligament is formed by the fascia of the External oblique muscle of the abdomen and passes from the anterior superior spine of the ilium to the spine of the os pubis. This ligament lies beneath the spermatic cord and is called crural arch.

LESSON CLIV.

Femoral hernia passes below Poupart's ligament and passes down towards the saphenous opening in the femoral or crural canal. If it passes through this opening it is called complete, if it does not it is called incomplete.

THE COVERINGS OF A FEMORAL HERNIA FROM WITHIN OUTWARD ARE:

1. Peritoneum.
2. Subserous areolar tissue, called the fascia propria of Cooper.
3. Septum crurale, which is from the femoral ring.
4. Crural sheath, which is from the transversalis fascia.
5. Cribriform fascia, which is from the saphenous opening.
6. Superficial fascia. Its superficial layer.
7. Skin.

The **femoral sheath** is funnel-shaped and has three compartments in it. THE OUTER ONE is for the femoral artery, THE MIDDLE ONE for the femoral vein, and THE INTERNAL ONE for the femoral canal. (Plate XVI).

The **femoral canal** is about three-fourths of an inch long and extends from the femoral ring above to the saphenous opening below.

THE RELATIONS OF THE FEMORAL CANAL.

IN FRONT.—Transversalis fascia.

BEHIND.—Iliac fascia.

EXTERNALLY.—A septum between it and the vein.

INTERNALLY.—Gimbernat's ligament and the meeting of the iliac fascia and the transversalis fascia.

The **femoral ring** is the upper opening of the femoral canal and is oval shaped about half an inch in diameter. It is larger in women.

THE RELATIONS OF THE FEMORAL RING.

IN FRONT.—Poupart's ligament and the deep crural arch which is a thickening of the transversalis fascia.

BEHIND.—The Pectineus muscle and the ilio-pectineal line.

INTERNALLY.—Gimbernat's ligament.

EXTERNALLY.—Femoral vein.

It is closed by the septum crurale, which is composed of fatty connective tissue and is perforated by lymphatics passing from the superficial to the deep group. There is a small lymphatic gland here. On the upper and outer angle of this ring is the deep epigastric artery. On the upper and inner margin is the obturator artery, when it arises from a common trunk with the deep epigastric artery which it does in about thirty per cent of the cases.

THE COVERINGS OF THE UMBILICAL HERNIA ARE:

1. Peritoneum.
2. Extra-peritoneal fatty tissue.
3. Transversalis fascia.
4. Prolongation of scar tissue of the umbilicus stretched out.
5. Superficial fascia.
6. Skin.

Congenital hernia (Plate CCLXXXVIII) is applied to hernia which takes place from birth or during any period of life, if the conditions favorable to its occurrence existed at birth. The vaginal portion of the tunica vaginalis may not close after the descent of the testicle in the fetus, and in this case when there is a hernia the intestine does not push forward a sac which comes from the parietal layer of the peritoneum, but instead it lies in a sac formed by the tunica vaginalis which is still connected with the peritoneal cavity. These forms of hernia are called congenital and are always OBLIQUE.

THE FOLLOWING ARE THE DIFFERENT KINDS OF CONGENITAL HERNIA:

1. **HERNIA IN THE TUNICA VAGINALIS TESTIS.** In this form of congenital hernia the intestine surrounds the testis and the sac is formed by the tunica vaginalis testis, because the intestine passes through the narrow canal which is present between the cavity of the peritoneum and the tunica vaginalis testis, the original communication between them is not obliterated.

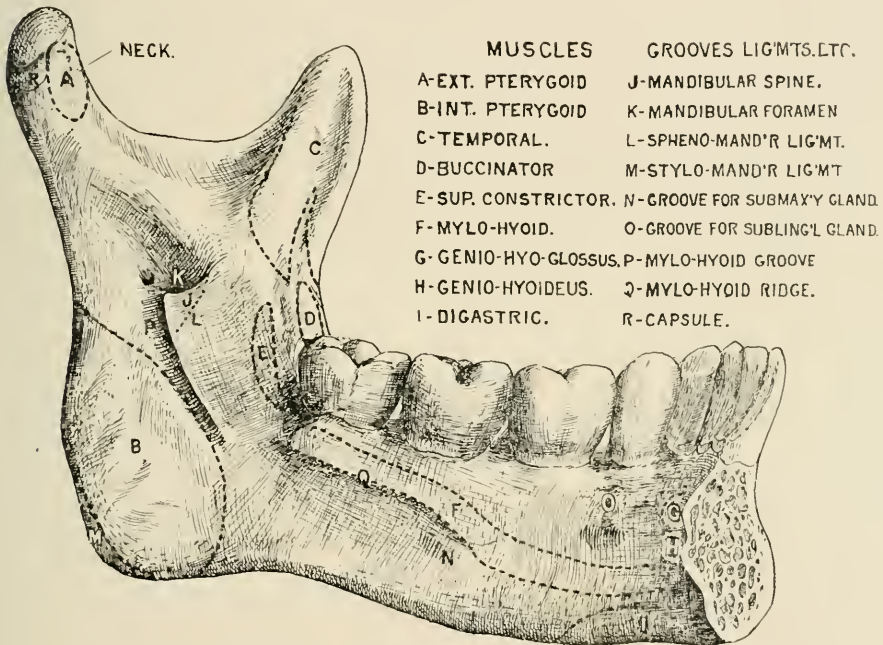
2. **HERNIA IN THE FUNICULAR PORTION OF THE TUNICA VAGINALIS.** In this form of congenital hernia the sac is formed by the original pouch of the peritoneum which descends with the testicle but is shut off from the tunica vaginalis testis by a thin septum. The canal above this septum being still present and communicating with the peritoneal cavity.

3. **INFANTILE HERNIA.** This form of congenital hernia is rare and is produced by the descent of the hernia through the internal abdominal ring but

behind this abnormal extension of the tunica vaginalis. In this case there are three layers of peritoneum in front of the hernia, two of them are from the tunica vaginalis and the third from the sac around the hernia. In this form of hernia the tunica vaginalis testis may pass up as high as the internal abdominal ring.

4. ENCYSTED HERNIA. This is the rarest of all forms of congenital hernia and is formed by the hernia pushing the closing septum of the internal abdominal ring as a diverticulum into the unclosed tunica vaginalis.

PLATE CCLVII.



INTERNAL SURFACE OF INFERIOR MAXILLARY BONE.

LESSON CLV.

VEINS.

Every vessel that leaves the heart is called an artery, and every vessel that enters the heart is called a vein. Arteries, as a rule, carry pure blood, while the veins carry impure blood but there are exceptions to each of these cases. The pulmonary arteries carry impure blood while the pulmonary veins carry pure blood. As a general thing veins have valves and arteries do not have valves, but there are exceptions to this rule, for the pulmonary artery has a valve and the pulmonary veins do not have valves. **Veins**, like arteries, have three coats, and the middle coat like that of the artery has sympathetic fibers around it but not so well developed as in the arteries.

The **veins of the dura mater** of the brain are called sinuses, also cavities in bones are called sinuses. After the blood has left the heart by way of the arteries and nourished the entire body, it comes back to the heart by means of veins. We have a pulmonary venous system and a systemic venous system. The veins of the upper extremity have been described on page 117 and the veins of the lower extremity have been described on page 192. We will now give the remaining veins of the body.

THE VEINS OF THE EXTERIOR OF THE HEAD AND FACE.

1. The **frontal vein** passes down the middle of the frontal bone to the inner canthus of the eye, after which it is called angular. It lies parallel with its fellow of the opposite side which it joins by a transverse branch just before it reaches the root of the nose. At their beginning the frontal veins communicate with the temporal veins. At the inner angle of the orbit they receive the supraorbital veins. Plate CXV.

2. The **supraorbital vein** lies on the forehead externally to the frontal vein which it joins to form the angular vein at the inner angle of the orbit.

3. The **angular vein** passes from the inner canthus of the eye where it is formed by the two veins just mentioned and passes to the base of the nose. Its radicles are (a) supraorbital, (b) frontal, (c) superior palpebral, and (d) nasal,

4. From the base of the nose this vein continues as **the facial**, which passes under the Zygomatici muscles and over the anterior border of the Masseter muscle in a groove on the inferior maxillary bone. From here it passes into the internal jugular after communicating with the external jugular. Its radicles are (a) angular, (b) inferior palpebral, (c) dorsal and lateral nasal, (d) anterior internal maxillary (deep facial), (e) coronary (superior and inferior), (f) buccal, (g) masseteric, (h) labial, (i) submental, (j) ascending palatine, (k) tonsillar, (l) glandular (parotid and submaxillary), (m) part of the temporo-maxillary.

5. **Temporal vein** is formed by the anterior temporal and posterior temporal which collects the blood from the side and the vertex of the head and after uniting above the zygoma, passes over the zygoma to be situated in front of the ear between the condyle of the jaw and the external auditory meatus. It now passes into the substance of the parotid gland where it receives the internal maxillary vein to form the temporo-maxillary vein. The radicles of this vein are (a) anterior temporal, (b) posterior temporal, (c) middle temporal, (d) parotid, (e) anterior auricular, (f) transverse facial.

6. The **internal maxillary vein** is formed by radicles which correspond to the branches of the internal maxillary artery. These radicles form the pterygoid plexus of veins, and this plexus of veins communicates with the facial vein by the anterior internal maxillary vein or deep facial.

7. The **temporo-maxillary vein** is formed by the temporal and internal maxillary veins in the substance of the parotid gland. At the angle of the jaw it joins the posterior auricular to form the external jugular. It may however, divide into an anterior branch which joins the facial vein and a posterior branch which joins the posterior auricular to form the external jugular.

8. The **posterior auricular vein** comes from a plexus on the side of the head and back of ear. It receives the stylo-mastoid vein and branches from the external ear. It joins the temporo-maxillary to form the external jugular.

9. The **occipital vein** is formed from a plexus at the back part of the vertex of the skull. It is placed deeply between muscles of neck. It passes over the suboccipital triangle under the Complexus muscle where it communicates with the vertebral vein. It empties into the internal jugular as a rule, but occasionally into the external jugular.

THE VEINS OF THE NECK. (Plate CXV.)

1. The **external jugular vein** collects the blood from the exterior part of the cranium and the deep part of the face. It is formed by the junction of part of the temporo-maxillary trunk and the posterior auricular veins in the substance of the parotid gland at the angle of the jaw. From this point it passes down beneath the Platysma myoides muscle over the Sterno-cleido-mastoid muscle and ends near the clavicle in the subclavian vein. Sometimes it empties into the internal jugular vein. It has two pairs of valves which do not prevent the regurgitation of blood, as they are not complete valves. The portion of the vein between the two valves is called a sinus. The upper pair of valves is about an inch and a half above the clavicle, while the lower pair is at its termination into the subclavian vein. Its radicles are (a) posterior external jugular, (b) suprascapular, (c) transverse cervical, (d) frequently the anterior jugular.

2. The **posterior external jugular vein** receives the blood from the integument and muscles in the upper and back part of the neck and also from the occipital region. It lies between the Splenius and Trapezius muscles. It empties into the middle of the external jugular vein.

3. The **anterior jugular vein** arises near the hyoid bone and is formed by the superficial veins of the submaxillary region. It collects the blood from the superficial muscles and integument of anterior and middle regions of neck. It joins its fellow just above the sternum. It empties into the subclavian or external jugular vein. It has no valves.

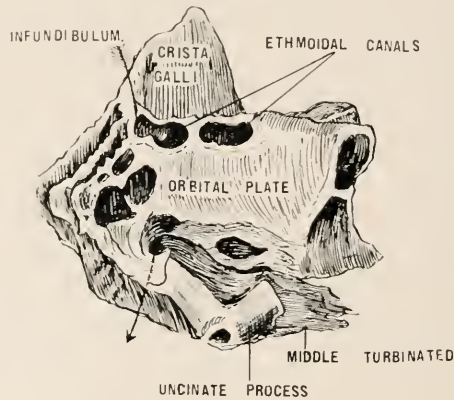
4. The **internal jugular vein** collects the blood from the brain and the superficial part of the face. It is formed by the inferior petrosal sinus and lateral sinus. It passes down the side of the neck in the common carotid sheath on the outer side of the carotid artery. For contents of this sheath see page 282. It joins the subclavian vein near the inner margin of the Scalenus anticus muscle. It is provided with a pair of valves which are placed about three-fourths of an inch above its termination. Its radicles are (a) pharyngeal, (b) lingual, and under lingual we have dorsal of tongue and lingual vena comites and ranine, (c) common facial, (d) superior thyroid, under which we have laryngeal and crico-thyroid, (e) middle thyroid, (f) occipital, which may be a radicle of the external jugular.

5. The **vertebral vein** commences in the occipital region and drains the deep muscles at the upper and back part of the neck. This is more of a plexus of veins than one large vein and they run down through the foramina in the

transverse processes of the cervical vertebræ. When they reach the sixth cervical vertebra they form two main trunks, one of which passes through the foramen in the transverse process of the sixth cervical vertebra and the other through that of the seventh. They now unite into a common trunk which empties into the back part of the innominate vein. One pair of valves guard its mouth. The radicles of the vertebral vein are (a) muscular, (b) dorsi-spinal, (c) meningo-rachidian, (d) ascending cervical, (e) deep cervical, (f) first intercostal.

The **deep cervical**, also called posterior vertebral, lies between the Complexus and the Semispinalis muscles. It accompanies the profunda cervicis artery. It empties into the lower end of the vertebral vein.

PLATE CCLVIII.



LATERAL VIEW OF THE ETHMOID.

LESSON CLVI.

The **axillary vein** commences at the lower border of the axillary space and receives radicles corresponding to the branches of the axillary artery. At the outer border of the first rib it continues as the subclavian vein. Below the lower border of the tendons of the Teres major and Latissimus dorsi it is called basilic. It has a pair of valves opposite the lower border of the Subscapularis muscle. At the termination of the cephalic vein and the subscapularis vein, valves are also found.

The **subclavian vein** is a continuation of the axillary vein at the outer border of the first rib to the inner end of the clavicle where it joins the internal jugular vein and makes the innominate vein. The external jugular vein empties into this vein and the anterior jugular may empty into it. The Scalenus anticus muscle and the phrenic nerve separate this vein from the subclavian artery. It has valves about an inch from its termination.

The **right innominate vein**, which is about an inch long, is formed behind the inner end of the clavicle by the internal jugular and subclavian veins. It

passes downward to join the left innominate vein at the inferior border of the first right costal cartilage to make the superior vena cava. Its radicles are, (a) right vertebral, (b) right internal mammary, which are two for each artery but uniting into a common trunk before entering into the innominate vein, (c) right inferior thyroid, which are three or four in number pass from the thyroid venous plexus into the left innominate vein, (d) right superior intercostal, receives the blood from the second and third intercostal spaces.

The right lymphatic duct opens at the angle where the right subclavian vein joins the right internal jugular vein.

The **left innominate vein**, which is about three inches long, is larger than the right. It is formed by the left internal jugular vein and the left subclavian vein at the inner end of the clavicle. It joins the right innominate vein to form the superior vena cava. The innominate veins have no valves. The radicles of the left innominate vein are, (a) left vertebral, (b) left internal mammary, which are two for each artery but unite into a common trunk before entering into the innominate vein, (c) left inferior thyroid, which are three or four in number pass from the thyroid venous plexus into the left innominate vein, (d) the left superior intercostal receives the blood from the second and third intercostal spaces.

The one on the right side passes down to enter the vena azygos major, while the one on the left side passes across the arch of the aorta to enter the left innominate vein, and receives the left bronchial vein. The highest intercostal vein, which comes from the first intercostal space, empties into the corresponding vertebral or innominate vein.

The **superior vena cava** is formed by the two innominate veins behind the junction of the first right costal cartilage with the sternum. It is about three inches long and passes down into the right auricle opposite the upper border of the third right costal cartilage. This vein has no valves. Its radicles are, (a) pericardiac, (b) mediastinal, (c) vena azygos major. It collects the blood from the upper half of the body.

When the blood is given off from the thoracic aorta into the intercostal arteries, it comes back by the intercostal veins, which would have no place to empty unless there was a special provision made for them. They cannot empty into the heart, and the inferior vena cava has no length above the Diaphragm, and the superior vena cava is too high for most of them, so they empty into veins called azygos veins which connect the superior and inferior vena cava. The azygos veins have no valves, but their tributaries do have valves. The azygos veins are: (Plate CXC).

1. The **vena azygos major**, also called right azygos vein. This vein commences at the first or second lumbar vertebra by a branch from (a) right lumbar veins, (b) or by a branch from the right renal vein, (c) or by a branch from the inferior vena cava. After passing through the aortic opening in the Diaphragm, it passes to the fourth dorsal vertebra along the right side of the vertebral column and ends in the superior ven cava just before it enters the pericardium. Its radicles are, (a) the lower ten intercostal veins on the right side,

(b) vena azygos minor from the left side, (c) œsophageal, pericardiac, and mediastinal veins, (d) the right bronchial vein, (e) the right superior intercostal vein.

2. The **vena azygos minor**, also called left lower or smaller azygos vein. This vein is formed by a branch from (a) the lumbar veins, (b) or from the left renal vein. After passing through the left crus of the Diaphragm, it passes along the left side of the vertebral column and at the ninth dorsal vertebra passes to the right behind the thoracic aorta and thoracic duct to end in the vena azygos major. Its radicles are, (a) four or five lower intercostal veins of the left side, (b) some œsophageal and mediastinal veins.

3. The **left upper azygos vein**, also called vena azygos tertius. The radicles of this vein are from the intercostal spaces between the left superior intercostal vein and the highest radicle of the vena azygos minor. These radicles join to form a main trunk, which empties into the vena azygos major or the vena azygos minor. Sometimes this vena azygos tertius is wanting, then the left superior intercostal vein takes its place.

The bronchial veins from the right side empty into the vena azygos major, while those of the left side open into the left superior intercostal or vena azygos tertius.

For veins of the abdomen see page 186.

LESSON CLVII.

THE PORTAL SYSTEM OF VEINS. (Plates CXXXVIII.)

The **portal system** collects the blood from the digestive tract and from the spleen. The veins of this system form the portal vein which enters the liver and breaks up into branches like an artery into the substance of the liver. This system consists of:

1. The **inferior mesenteric vein**, which drains the blood from the rectum, sigmoid flexure, and the descending colon. This vein empties into the splenic vein after passing behind the transverse part of the duodenum and the pancreas and over the left kidney. Its hæmorrhoidal radicles anastomose with the hæmorrhoidal branches of the internal iliac.

2. The **superior mesenteric vein** collects the blood from the small intestine, the cæcum, the ascending colon, and transverse colon. The radicles of this vein correspond with the branches of the superior mesenteric artery, just as the radicles of the inferior mesenteric correspond to the branches of the inferior mesenteric artery. This vein passes in front of the transverse portion of the duodenum and behind the pancreas to join the splenic vein at the upper border of the pancreas where it forms the portal vein.

3. The **splenic vein** commences in the hilum of the spleen by five or six branches which unite to form one main trunk. It now passes below the splenic artery and behind the upper border of the pancreas in front of the abdominal aorta to join the superior mesenteric vein.

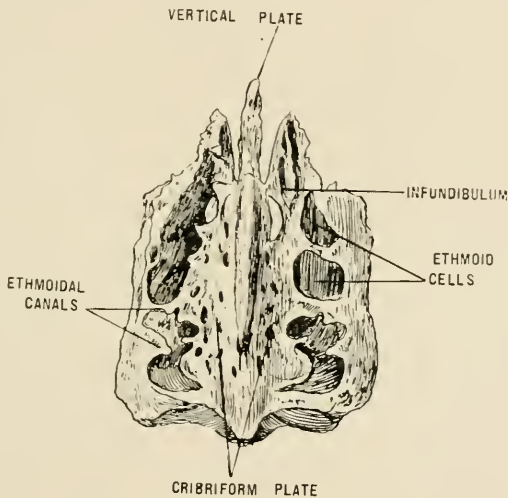
4. The **gastric vein**, also called coronary, is a large vein which passes along the lesser curvature of the stomach to the cardiac end where it receives radicles

from the œsophagus and then passes behind the lesser sac of the peritoneum into the portal vein.

5. The **portal vein** is formed by the splenic vein and the superior mesenteric vein behind the neck of the pancreas. It passes behind the first part of the duodenum and then in the lesser omentum to the transverse fissure of the liver. It now divides into right and left branches for the right and left lobes of the liver and also gives a branch to the Spigelian lobe. For the further subdivision of the portal vein see page 190.

The portal vein most always receives the cystic vein, although it may sometimes end in the right branch of the portal vein.

PLATE CCLIX.



SUPERIOR VIEW OF THE ETHMOID.

THE VEINS OF THE HEART ARE:

1. The **great cardiac vein** (coronary vein) commences at the apex of the heart and passes to the base of the ventricles in the anterior interventricular groove. From here it passes to the left in the auriculo-ventricular groove to the back part of the heart where it opens into the coronary sinus. Its opening has a pair of valves. Its radicles are, (a) those which drain the right ventricle, (b) those from the left ventricle, (c) those from the left auricle. These radicles have valves.

2. The **posterior cardiac vein** (the middle cardiac vein) commences at the apex of the heart and passes along the posterior interventricular groove to empty into the coronary sinus, where it has a valve. Its radicles are, (a) those from the posterior surface of the left ventricle, (b) those from the posterior surface of the right ventricle.

3. The **left cardiac veins** collect the blood from the posterior surface of the left ventricle and open into the coronary sinus. There are three or four of these.

4. The **anterior cardiac veins** collect the blood from the anterior surface of the right ventricle and empty into the lower part of the right auricle. There are three or four of these veins, and the largest one, which is called the vein of Galen passes along the right border of the heart.

5. The **right coronary vein** (small coronary) empties into the coronary sinus after passing between the right auricle and the right ventricle. Its radicles are, (a) from the back part of the right auricle, (b) from the back part of the right ventricle.

6. **Venæ Thebesii**, also called *venæ cordis minime*, open by small orifices on the inner surface of the right auricle. These orifices are called *foramina Thebesii*.

7. The **coronary sinus** is a dilatation situated in the posterior part of the left auriculo-ventricular groove. It receives all the veins just mentioned except the *venæ Thebesii*, and it also receives the oblique vein of Marshall, which is from the back part of the left auricle. This vein empties into the right auricle of the heart between the inferior vena cava and the auriculo-ventricular opening. It is guarded by the valve of Thebesii (coronary). All these veins of the heart, which empty into the coronary sinus have valves except the oblique vein of Marshall.

THE VEINS OF SPINAL COLUMN AND CORD.

The veins of the spinal column and cord are: (Plates CI-CII.)

1. **Dorsi-spinal veins**, which collect the blood from the back on either side of the spinous processes. These veins form a great plexus, which join the veins in the spinal canal by branches which perforate the *ligmenta subflava* and by other branches which pass through the intervertebral foramina. These veins end in the vertebrals in the neck, in the intercostal veins, and in lumbar and sacral veins in their respective regions.

2. **Meningo-rachidian veins**, which are situated in the spinal canal, form two great columns, (a) the anterior longitudinal spinal veins which pass from the foramen magnum to the base of the coccyx. There are two of these anterior longitudinal spinal columns, one on each side of the posterior surface of the bodies of the vertebrae. The radicles of these veins are *venæ basis vertebrarum*. These veins communicate with the dorsi-spinal veins, vertebral veins, intercostal veins, lumbar and sacral veins. (b) The posterior longitudinal spinal veins are situated along the posterior border of the spinal canal. They communicate freely with the anterior ones, the dorsi-spinal veins, vertebral veins, intercostal veins, lumbar veins and sacral veins. The meningo-rachidian veins are not of uniform caliber and communicate freely with one another, thus forming sort of a plexus.

3. **Venæ basis vertebrarum** pass from the posterior surface of the vertebrae to join the transverse trunk connecting the anterior spinal veins. They collect the blood from the substance of the bone and are similar to the veins of the diploe found in the bones of the cranium.

4. The **medullary spinal veins** collect the blood from the substance of the cord which forms a venous plexus around the entire surface of the cord between

the arachnoid and pia mater. In the upper part of the neck these veins empty into the inferior cerebellar veins or the inferior petrosal sinus. Below this they empty into the veins of the spinal canal. None of the spinal veins have valves.

LESSON CLVIII.

VEINS OF DIPLOE.

These veins lie between the two plates of the bones of the cranium and can be seen by removing the outer plate of the skull. They are, (1) the frontal, which empties into the supraorbital vein, (2) the anterior temporal which joins the deep temporal vein, (3) posterior temporal which joins the lateral sinus, (4) the occipital which joins the occipital vein or lateral sinus.

Emissary veins are small veins which pass through foramina in the bones of the cranium to connect the sinuses with the external veins of the head. The principal ones are as follows: (1) One which passes through the parietal foramen to connect the veins of the scalp with the superior longitudinal sinus. (2) One which passes through the mastoid foramen to connect the posterior auricular vein or occipital vein with the lateral sinus. (3) One which passes through the anterior condyloid foramen to connect the vertebral vein and deep veins of neck with occipital sinus. (4) One which passes through the posterior condyloid foramen to connect the lateral sinus with the deep veins of the neck. (5) One which passes through the foramen ovale. (6) Two or three which pass through the middle lacerated foramen. (7) One which passes through the foramen of Vesalius. The fifth, sixth, and seventh all connect the cavernous sinus with pterygoid and pharyngeal plexuses. (8) One which passes through the carotid canal to connect the cavernous sinus with the internal jugular vein.

CEREBRAL VEINS.

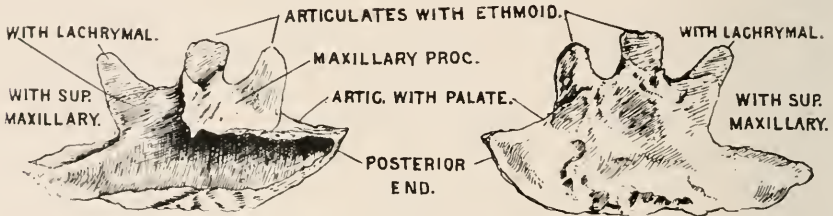
The **cerebral veins** have thin coats and no muscular coat or valves. They are divided into a superficial set and a deep set. **Under the superficial set** we have (1) superior cerebral veins, which are lodged in the fissures on the cerebral surface and pass forward and inward to the superior longitudinal sinus. (2) The median cerebral veins which collect the blood from the convolutions of the mesial surface of the hemispheres. These veins empty into the superior veins or into the inferior longitudinal sinus.

(3) **Inferior cerebral veins** collect the blood on the lower part of the outer and on the under surface of the cerebral hemisphere. Under these veins we have, (a) middle cerebral which runs along the fissure of Sylvius on the under surface of the temporal lobe and empties into the cavernous sinus, (b) the great anastomotic vein of the Trolard runs along the horizontal limb of the fissure of Sylvius and empties into the anterior part of the cavernous sinus, (c) the other veins on the under surface of the brain empty into the superior petrosal sinus and lateral sinus.

Under the deep set, we have (1.) *Venæ Galeni*, which are two in number. They are formed by the *vena corporis striati* and *vena choroidea*. They pass back and out of the transverse fissure to enter the straight sinus. These two veins generally unite into one vein, just before the entrance into the straight sinus. (2.) The basilar vein is formed by the junction of the deep Sylvian vein, inferior striate vein, and anterior cerebral veins. It now passes backward over the *crus cerebri* to enter the vein of Galen just before its junction with the vein of the opposite side. The **cerebellar veins**. Under these we have, (1) superior ones, which pass forward and inward to end in the straight sinus and the veins of Galen, but some of them pass outward to the lateral and the superior petrosal sinus. (2) the inferior cerebellar veins end in the lateral sinus, superior petrosal sinus, and occipital sinus.

The veins of the *medulla oblongata* and *pons* end in the inferior petrosal sinus and lateral sinus.

PLATE CCLX.



INFERIOR TURBINATED BONE.

LESSON CLIX.

THE SINUSES OF THE DURA MATER. (Plates CLXXVIII-CLXXIX.)

The **sinuses of the dura mater** are as follows:

1. The **superior longitudinal sinus** commences at the foramen cæcum and passes along the upper border of the *falx cerebri* to end in the torcular Herophili, where it receives the occipital sinus and the straight sinus. The blood which passes through the superior longitudinal sinus and the occipital sinus turns to the right at the torcular Herophili to pass into the right lateral sinus, while the blood from the straight sinus passes into the left lateral sinus. However, this may be vice versa. At the foramen cæcum a small vein communicates with the veins of the nasal fossæ in children. This sinus on cross section is triangular with apex below next to the *falx cerebri*. The *chordæ Willisii* are fibrous glands which constrict this sinus and take the place of valves. Most of the radicles of this sinus pass into it in such a manner that the blood is received at right angles to or against the current in the sinus. It receives veins from the *diploë* and the *dura mater*, the superior cerebral veins, and veins from the *pericranium* after passing through the parietal foramina.

The **torcular Herophili** is a dilatation at the point on the right side of the internal occipital protuberance where the superior longitudinal, occipital and straight sinuses meet.

2. The **inferior longitudinal sinus** passes along the lower border of the falx cerebri. It receives veins from the falx cerebri and also some from the sagittal surface of the hemispheres. It ends in the straight sinus, and on cross section is circular. This sinus, as well as the preceding one, increases in size from before backward.

3. The **straight sinus** connects the inferior longitudinal sinus with the superior longitudinal sinus and is situated at the junction of the falx cerebri with the tentorium cerebelli. The inferior longitudinal sinus, venæ Galeni, and superior cerebellar veins empty into it.

4. and 5. The **lateral sinuses** are two in number and are situated where the tentorium cerebelli joins the bone. The right one, after receiving the blood from the superior longitudinal and occipital sinus, passes to the right as far as the petrous portion of the temporal bone. It then passes downward and inward to the jugular foramen, where it receives the inferior petrosal sinus to make the jugular vein. It also receives the superior petrosal sinus at the base of the petrous portion of the temporal bone. The left lateral sinus has a similar description but receives the blood from the straight sinus. It occasionally receives the blood from the superior longitudinal and occipital sinus, and then the right lateral sinus receives the blood from the straight sinus.

6. and 7. The **occipital sinus** which is the smallest of these sinuses, may be double. It is situated where the falx cerebelli joins the bone, and as said before, it empties into the torcular Herophili.

These seven sinuses are situated on the upper and back part of the skull, while the remaining sinuses of the dura mater are situated at the base of the skull.

8. and 9. The **cavernous sinuses** pass from the sphenoidal fissure to the apex of the petrous portion of the temporal bone. They are formed by the ophthalmic vein and end by dividing into the superior and inferior petrosal sinuses. In each cavernous sinus the following structures are found; (a) The third cranial nerve, (b) the fourth cranial nerve, (c) the ophthalmic division of the fifth cranial, (e) the sixth cranial, (f) the internal carotid artery. For position of these structures in this sinus see plate CCXXXII. The facial vein communicates with this sinus through the ophthalmic vein. The circular sinus connects the two cavernous sinuses.

10. The **circular sinus** surrounds the hypophysis. The anterior segment of this circle is larger than the posterior one. One or the other of these segments may be absent.

11. and 12. The **superior petrosal sinuses** are two in number, one on either side, and they connect the cavernous with the lateral sinus. They are situated along the superior border of the petrous portions of the temporal bone. Veins from tympanic cavity, some cerebellar veins, and inferior cerebral veins, pass into it.

13. and 14. The **inferior petrosal sinuses** pass from the cavernous sinus to the jugular foramen where they join the lateral sinus to make the internal jugular vein. They are situated where the posterior border of the petrous portion of the temporal bone joins the basilar process of the occipital.

15. The **transverse sinus** (basilar sinus) connects the two inferior petrosal sinuses. It passes over the basilar process of the occipital bone.

THE MUSCLES OF THE ISCHIO-RECTAL REGION. (Plate CCLXXI.)

Corrugator cutis ani.—DESCRIPTION.—This muscle radiates from the orifice of the anus and is a thin involuntary muscle.

ORIGIN.—From the true skin externally from the anus.

INSERTION.—Into the submucous tissue internally.

ACTION.—To raise the skin in ridges around the anus.

NERVE SUPPLY.—Sympathetic nerve.

BLOOD SUPPLY.—Inferior hemorrhoidal.

External sphincter ani.—DESCRIPTION.—This muscle surrounds the margin of the anus and is elliptical in shape and thin and flat in form. It is about an inch broad opposite the anus, and from its anterior to its posterior extremity it is about three inches. It consists of two planes of muscular fibers.

ORIGIN.—From the tip of coccyx by a narrow tendon and from superficial fascia in front of bone.

INSERTION.—Into the central tendons of perineum where it joins with the Transversus perinæi, Levator ani, and Accelerator urinæ.

ACTION.—To close anus.

NERVE SUPPLY.—From the anterior division of the fourth sacral and inferior hæmorrhoidal branch of the internal pudic nerve.

BLOOD SUPPLY.—Inferior hemorrhoidal from internal pudic.

Internal sphincter ani.—DESCRIPTION.—This muscle surrounds the lower part of the rectum for about an inch. It is composed of involuntary muscular fibers.

ACTION.—To close the anus.

NERVE SUPPLY.—Hæmorrhoidal.

BLOOD SUPPLY.—Inferior hemorrhoidal from internal pudic.

Levator ani.—DESCRIPTION.—This muscle which is thin and broad is situated on the side of the pelvis. It helps to support the viscera in the pelvic cavity. Sometimes the anterior portion of this muscle is separated from the posterior portion by connective tissue, and then it is called the Levator prostatae.

ORIGIN.—From the posterior surface of the body and ramus of the os pubis on the outer side of the symphysis. Also from the inner surface of the spine of the ischium and from the fascia between these points.

INSERTION.—(1) The posterior fibers are inserted into the sides of the apex of the coccyx, and those fibers just in front of these unite with those of the opposite side extending between the coccyx and the margin of the anus. (2) The middle fibers, which form the greater portion of the muscle, are inserted

into the sides of the rectum blending with the fibers of the sphincter muscles. (3) The anterior fibers, which are the longest, descend upon the side of the prostate gland to join beneath it with fibers of the opposite side, and also blending with fibers of the External sphincter and Transversus perinæi at the central tendon.

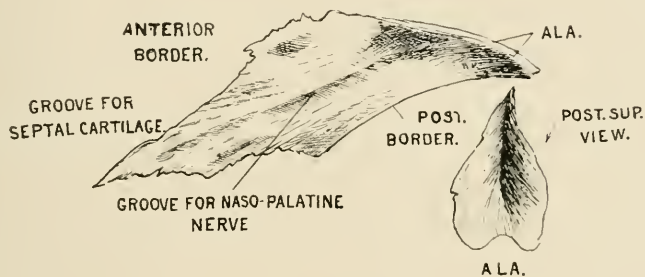
ACTION.—It is a muscle of forced expiration. It also supports the lower end of the rectum, vagina, and bladder during efforts of expulsion.

NERVE SUPPLY.—Branch from the anterior division of the fourth sacral and a branch from the pudic nerve which sometimes comes from the perineal or from the inferior hæmorrhoidal division.

BLOOD SUPPLY.—Internal pudic.

Coccygeus.—**DESCRIPTION.**—This muscle is situated parallel to the Levator ani but behind it. Its upper border is separated from the lower border of the Pyriformis muscle by the internal pudic vessels and nerves.

PLATE CCLXI.



THE VOMER.

ORIGIN.—From the apex of the spine of the ischium and from the lesser sacro-sciatic ligament.

INSERTION.—Into the margin of the coccyx and side of lower piece of sacrum.

ACTION.—Raises and supports coccyx.

NERVE SUPPLY.—Branch from the fourth and fifth sacral nerves.

BLOOD SUPPLY.—Internal pudic.

LESSON CLX.

MUSCLES OF THE PERINEUM IN THE MALE. (Plate CCLXXI.)

Transversus perinæi.—**DESCRIPTION.**—This muscle, which passes across the back part of the perineal space, is a narrow muscular slip.

ORIGIN.—From the inner and forepart of the tuberosity of the ischium by a small tendon.

INSERTION.—Into the central tendon of the perineum.

NERVE SUPPLY.—Perineal branch of the internal pudic.

BLOOD SUPPLY.—Internal pudic.

Accelerator urinæ.—(Bulbo-cavernosus-Ejaculator seminis.)—**DESCRIPTION.**—This muscle is situated in the middle line of the perineum just in front of the anus. It consists of two similar parts united in the middle line by a tendinous raphe.

ORIGIN.—From the central tendon of the perineum, and from the median raphe in front.

INSERTION.—Into the anterior surface of the triangular ligament into the bulb and adjacent parts of the corpus spongiosum, and into the tunica albuginea of corpora cavernosa.

ACTION.—To empty the urethra and assist the erector penis.

NERVE SUPPLY.—Perineal branch of the internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

Erector penis.—(Ischio-cavernosus.)—**DESCRIPTION.**—This muscle covers part of the crus penis and is situated on either side of the lateral boundary of the perineum. This muscle is broad in the middle and narrow at the extremities.

ORIGIN.—From the inner surface of the tuberosity of the ischium, from the surface of the crus, and from the adjacent portion of the ramus of the ischium.

INSERTION.—Into the sides and into the under surface of the crus penis by an aponeurosis.

ACTION.—By compressing the crus penis, it retards the blood through the veins and in this manner keeps the organ erect.

NERVE SUPPLY.—Perineal branch of internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

Compressor urethræ.—(Constrictor urethræ.)—**DESCRIPTION.**—This muscle is situated between the two layers of the triangular ligament and surrounds the membranous portion of the urethra.

ORIGIN.—From the junction of the rami of the os pubis and ischium, extending to half an inch or more.

INSERTION.—Each portion of this muscle divides into two fasciculi which surround the urethra from the prostate gland behind to the bulbous portion of the urethra in front. They unite at the upper and lower surfaces of this tube with the muscle of the opposite side.

ACTION.—These muscles acting together assist expelling the fluids and compressing the membranous portion of the urethra.

NERVE SUPPLY.—Perineal branch of the internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

LESSON CLXI.

MUSCLES OF THE PERINEUM IN THE FEMALE. (Plate CCLXXI.)

Transversus perinæi.—**DESCRIPTION.**—This is a small muscular slip in the female which passes across the back part of the perineal space.

ORIGIN.—From the inner and forepart of the tuberosity of the ischium by a small tendon.

INSERTION.—Into the central tendon of the perineum.

ACTION.—This muscle with its fellow fixes the central tendon.

NERVE SUPPLY.—Perineal branch of internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

Sphincter vagina.—**DESCRIPTION.**—The Sphincter vagina which surrounds the orifice of the vagina is the homologue of the Accelerator urinæ in the male.

ORIGIN.—Posteriorly from the central tendinous part of the perineum where it blends with the External sphincter ani.

INSERTION.—Into the corpora cavernosa of the clitoris, and a fasciculus passes over the body of the clitoris to compress its dorsal vein.

ACTION.—To diminish the orifice of the vagina.

NERVE SUPPLY.—Perineal branch of the internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

Erector clitoridis.—**DESCRIPTION.**—This muscle is the homologue of the Erector penis in the male, but is a smaller muscle.

ORIGIN.—From the inner surface of the tuberosity of the ischium behind the crus clitoridis, and also from the surface of the crus and the adjacent portion of the ramus of the ischium.

INSERTION.—Into the sides and upper surface of the crus clitoridis.

ACTION.—To maintain the organ erect by pressing on the crus clitoridis and retarding the return of blood through the veins.

NERVE SUPPLY.—Perineal branch of the internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

Compressor urethra.—(Constrictor urethra).—

ORIGIN.—From the margin of the descending ramus of the os pubis.

INSERTION.—The fibers from the front part of the muscle cross the sub-pubic arch in front of the urethra to blend with its fellow of the opposite side, while fibers from the posterior portion pass inward to blend with the walls of the vagina behind the urethra.

ACTION.—To expell the urine and assist in erection.

NERVE SUPPLY.—Perineal branch of the internal pudic.

BLOOD SUPPLY.—Superficial perineal from internal pudic.

LESSON CLXII.

THE PERINEUM. (Plate CCLXIX.)

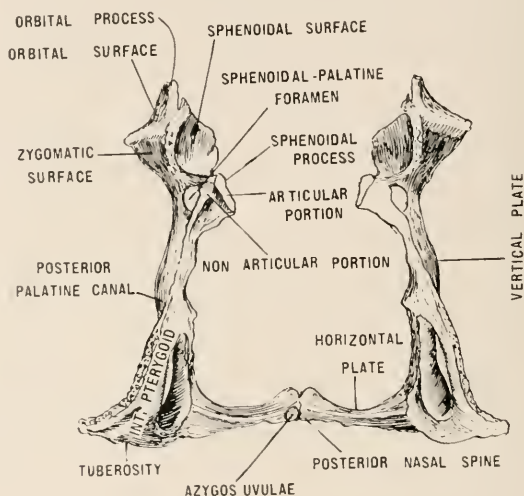
The word **Perineum** is used in three different senses. (1) it includes the entire outlet of the pelvis, which extends from the apex of the sub-pubic arch in front to the tip of the coccyx behind, and laterally between the tuberischii. (2) It is the part of the pelvic outlet in front of a line connecting the tuberischii. This is called the true perineum, while the part behind this line is called the anal, ischio-rectal, or false perineum. (3) In the surgical and obstetrical sense of the word the term may include in the female all the deeper part between the posterior wall of the vagina and the anterior wall of the rectum. This is called the perineal body.

The **ischio-rectal fossæ** are situated on each side of the lower end of the rectum, having on the outer side of each fossa, the tuberosity of the ischium, The ischio-rectal fossa is in the form of a pyramid with its apex corresponding to the junction of the Levator ani and Obturator muscles. Its base is between the anus and the tuberischii. It is bounded on the inner side by the Sphincter ani, Levator ani, and Coccygeus muscles; and behind by the edge of the Gluteus maximus and the great sacro-sciatic ligament. It is the site of abscesses and is filled with a mass of adipose connective tissue. (Plate CCLXX.)

THE FASCLE OF THE PERINEUM ARE:

1. The superficial layer of the superficial fascia, which is continuous with the sub-cutaneous fascia of the thighs, is thick and loaded with fat. This is the lowest of all the fascia of the perineum.

PLATE CCLXII.



THE PALATE BONE, POSTERIOR VIEW.

2. The deep layer of the superficial fascia is called Colles' fascia. It is not thick, but very strong. It is attached posteriorly to the perineal ledge, anteriorly it becomes continuous with the external fascial investment of the scrotum and the fascial covering of the penis. It extends laterally to the rami of the pubis and ischium. Some anatomists call this fascia the **ANTERIOR LEAFLET OF THE TRIANGULAR LIGAMENT**.

3. The anterior layer of the deep perineal fascia is triangular in shape like Colles' fascia, being bounded on either side by the ramus of the pubis and ischium and extending in front from the pubic arch and sub-pubic ligament to the perineal ledge posteriorly. Some anatomists call this **THE MIDDLE LEAFLET OF THE TRIANGULAR LIGAMENT**.

4. The posterior layer of the deep perineal fascia is called by some anatomists **THE POSTERIOR LEAFLET OF THE TRIANGULAR LIGAMENT** and has the same attachments as the middle leaflet of the triangular ligament.

THE "WHITE LINE," OR ARCUS TENDINEUS, extends from the inner aspect of the spine of the ischium to the back of the os pubis, external to the symphysis, and is formed by a thickening of the obturator fascia where the fascia of Levator ani muscle meets the obturator fascia. This line, of course, is not straight because it conforms to the curve of the pelvic wall.

BUCK'S FASCIA is a continuation of Colles' fascia which extends forward upon the penis, which it invests completely, as far as the glands.

THE **triangular ligament of the urethra**. One set of anatomists describe THE ANTERIOR LAYER OF THE DEEP PERINEAL FASCIA as the triangular ligament, while **another set** include THE POSTERIOR LAYER OF THE DEEP PERINEAL FASCIA, thus making two layers of the triangular ligament. Still a **third set** of anatomists include COLLES' FASCIA in the triangular ligament, thus making three leaflets in the triangular ligament. Where these three triangular leaflets meet posteriorly is called THE PERINEAL LEDGE, and as they pass forward towards the symphysis pubis there are two spaces between these three leaflets. The one between the first two leaflets is called THE SUPERFICIAL PERINEAL INTERSPACE, and contains the following structures:

1. The crura of the corpora cavernosa.
2. The bulb of the corpus spongiosum.
3. Scattered fibers of the Superficial transverse perinæi muscle.
4. Arteries of the corpora cavernosum and dorsal vessels of the penis.
5. Dorsal nerves of the penis.
6. Superficial perineal vessels and nerves.

The space between the second and third leaflets of the triangular ligament is called THE DEEP PERINEAL INTERSPACE and contains:

1. The membranous urethra.
2. Cowper's glands.
3. Internal pudic arteries.
4. Pudic veins.
5. The pudic lymphatics.
6. Dorsal nerves of the penis.
7. The deep Transverse perinæi and Compressor urethra muscles.

The **central tendon of the perineum** is about half an inch in front of the anus, in the middle of the perineal ledge, and is the place where the External sphincter ani and Accelerator urinae and Transverse perinæi muscles meet.

Alcock's canal is about two inches in length and is formed by a delamination of the obturator fascia. It is situated on the outer wall of the ischio-rectal fossa, extending from the lesser sacro-sciatic foramen to the lower border of the triangular ligament. The internal pudic vessels and nerve pass through this canal. (Plate CCLXX.)

The **pelvic fascia** lines the cavity of the pelvis and at the white line it divides into (1) RECTO-VESICAL FASCIA, which is called visceral layer of the pelvic fascia. This layer descends from the white line over the Levator ani muscle, over the prostate gland, rectum, vesiculae seminales and the bladder. It forms the true ligaments of the bladder. (2) THE OBTURATOR fascia, which is called the

parietal layer of the pelvic fascia. This layer passes from the white line on the pelvis to cover the Obturator internus muscle, and above Alcock's canal gives off the anal fascia (ischio-rectal) over the lower surface of the Levator ani muscle. This fascia with the corresponding fascia of the opposite side forms the deep superior layer of the triangular ligament.

LESSON CLXIII.

LYMPHATIC SYSTEM. (Plates CCLXXXIX-CCXC.)

The **lymphatic system** consists of lymphatic vessels, and lymphatic nodes. The lymphatic vessels of the small intestine are called lacteals or chyloferous vessels because during the process of digestion they contain chyle which they carry into the blood through the thoracic duct. The lymphatic vessels are present in all the part of the body except the hair, nails, cuticle, and cartilage. The lymphatic system is in the form of the human body. It commences in microscopic spaces which join one another to make larger spaces until they finally form the two lymphatic ducts, the right and the left. The left one is called the **thoracic duct** because it passes through the thorax. It collects lymph from all the body except the right half of the head, the right half of the thorax, and the upper surface of the liver, and the right arm. The lymph in these structures just named pass into the **right lymphatic duct**. This right lymphatic duct is about half an inch long and empties into the right subclavian vein. The left lymphatic or thoracic duct is about eighteen inches long and passes upon the vertebral column behind the arch of the aorta, it finally ends in the left subclavian vein. This duct may be double for part of its way or through its entire course, and it may empty into the vena azygos major. It has constrictions through its entire course and a double valve at its termination.

Every cell in the body is surrounded by lymph and is therefore an aquatic animal. These cells receive their food from the lymph into which they also throw their waste products.

The **lymphatic vessels in the body** are in two sets, superficial and deep. The superficial lymphatics pass just under the skin with the superficial veins and they pierce the deep fascia to join the deep lymphatic vessels. The deep lymphatics although not so numerous as the superficial ones are larger and accompany the deep blood vessels. The lymphatic, absorbent, or conglobate nodes are small bodies of adenoid tissue which the lymphatic vessels pass through on their way to the thoracic and lymphatic ducts. These nodes vary in size from very small ones which are microscopic, to large ones which are about the size of a small bean. Their color is pinkish-gray, but those in the bronchial region are a darker color.

The **lymphatics**, like veins, have three coats, but the smallest lymphatic vessels have one coat which is composed of epithelial cells. Those vessels which have three coats have the following arrangement, (1) AN INNER COAT of epithelium and a small amount of yellow fibrous tissue; (2) A MIDDLE COAT composed of muscular tissue and yellow fibrous tissue; (3) AN OUTER COAT which consists of white fibrous tissue and a little of the yellow fibrous tissue. All three of these coats put together are transparent. Valves are present in

lymphatic vessels to prevent the backward flow of the lymph. They are formed by folds of the lining membrane and their position is marked by a circular constriction.

The **thoracic duct** has three coats, (1) AN INTERNAL or endothelial, (2) A MIDDLE of white connective tissue, (3) AN EXTERNAL of areolar tissue. There are numerous valves in the thoracic duct especially at its upper end, and there is a pair at its termination to prevent blood from entering the duct.

THE RELATIONS OF THE THORACIC DUCT ARE:

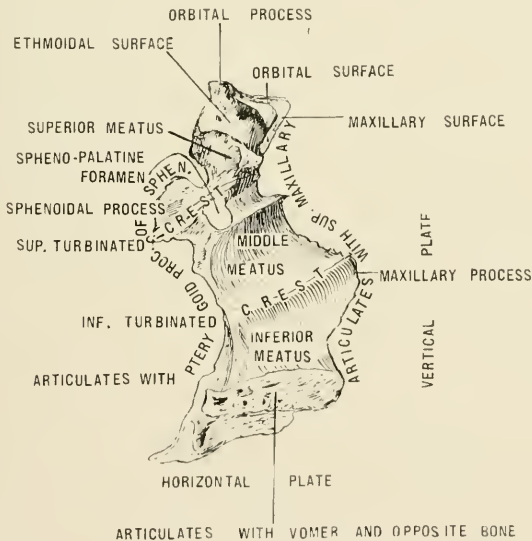
BEHIND.—(1) The body of the second lumbar vertebra, (2) Bodies of the seven lower thoracic vertebrae, (3) Anterior common ligament, (4) Lower right intercostal arteries, (5) Vena azygos minor, (6) Vena azygos tertius, (7) Upper thoracic vertebrae.

ON RIGHT SIDE.—(1) Right crus of the Diaphragm, (2) Vena azygos major, (3) Right pleura, (4) Œsophagus.

IN FRONT.—(1) Aorta and right crus of the Diaphragm, (2) Pericardium, (3) Œsophagus, (4) Arch of the aorta, (5) First portion of subclavian artery.

ON LEFT SIDE.—(1) Aorta, (2) Left pleura, (3) Vena azygos minor, (4) Vena azygos tertius.

PLATE CCLXIII.



THE LATERAL VIEW OF THE PALATE BONE.

The **receptaculum chyli** is the beginning of the thoracic duct. It is an irregular, sacculated and fusiform sac. It has no valves in it, and its dimensions are one and a half by three-quarters of an inch. It is situated in front of the second lumbar vertebra.

A **lymphatic node** consists of an outer part called a capsule, which is made of white fibrous tissue and a small amount of smooth muscular tissue. From the inner surface of this capsule trabeculae pass towards the center of the node.

These trabeculae are broad at the attachment of the capsule but small in the central portion. The outer portion of the node is called cortex and the inner portion is called medulla. These trabeculae form numerous divisions in the node, and these divisions are partly filled with pulp. The space between the pulp and the division wall is called the lymph sinus and is crossed by a network of adenoid reticular tissue. This pulp is a mass of leucocytes. The hilum is a notch where the arteries enter and the veins and efferent vessels leave the node. These nodes make white blood corpuscles.

There are about seven hundred lymphatic nodes in the body and they are all situated beneath the deep fascia except the superficial inguinal nodes.

LESSON CLXIV.

The **superficial lymphatic vessels** of the upper extremity pass from the tips of the fingers towards the shoulder with the superficial veins. Those on the inner side of the arm run with the ulnar veins towards the elbow then with the basilic vein to the axillary glands and deep vessels. Those on the outer side of the arm run with the radial veins to the elbow, and at this point some join the basilic group, while others run with the cephalic vein to the axillary nodes. A few of this last set pass between the Deltoid muscle and the Pectoralis major to the subclavian nodes.

The **deep lymphatic vessels of the upper extremity** pass with the deep blood vessels. They accompany the following arteries in the forearm: (1) RADIAL, (2) ULNAR, (3) ANTERIOR INTEROSSEOUS, (4) POSTERIOR INTEROSSEOUS. They communicate with the superficial lymphatic vessels at intervals. They accompany the brachial artery from the elbow and pass through the axillary and subclavian nodes to the thoracic duct on the left side, while those on the right side pass to the right lymphatic duct.

The **superficial lymphatic nodes of the upper extremity** are not numerous. In the cubital fossa there are two or three and above the internal condyle near the basilic vein there is one or two.

The **deep lymphatic nodes of the upper extremity** are found along the radial and ulnar vessels. A few small ones are found along the inner side of the brachial artery, and one or two just above the inner condyle. There are ten or twelve around the axillary vessels which drain the front of the chest and the skin of the back. The subclavian nodes are two or three which are connected with the axillary nodes and deep cervical nodes. They lie under the clavicle.

The **superficial lymphatic vessels of the lower extremity** lie in the superficial fascia. They are divided into two groups, (1) A LARGE INTERNAL GROUP which follows the internal saphenous vein to the vertical set of the superficial inguinal nodes. From these superficial inguinal nodes some efferent vessels pass through the cribriform fascia and femoral sheath to a node in the femoral canal by which it communicates with the vessels of the trunk, and others pass through the fascia lata to the deep inguinal nodes. (2) AN EXTERNAL GROUP, which is smaller and is situated on the outer side of the foot, sends one set of vessels across the tibia just below the knee to join the internal group, while the

other set passes with the external saphenous vein to join the popliteal nodes.

The **deep lymphatic vessels of the lower extremity** accompany the following arteries: (1) ANTERIOR TIBIAL, (2) POSTERIOR TIBIAL, (3) PERINEAL, to the popliteal nodes. From the popliteal nodes they pass with the femoral vein to the deep inguinal nodes, and then under Poupart's ligament to the nodes around the external iliac vessels. The lymphatic vessels in the gluteal region pass to the gluteal nodes in the great sacro-sciatic foramen. The lymphatic vessels of the ischiatic region have a similar course.

The **superficial lymphatic nodes of the lower extremity** are, (1) eight or ten SUPERFICIAL INGUINAL NODES which lie just under the skin. They consist of two sets, (a) the upper oblique along Poupart's ligament, which drains the scrotum, penis, abdominal wall, perineal and gluteal regions, and urethral mucous membrane. (b) The vertical set which surrounds the saphenous opening and receive the superficial vessels of the lower extremity.

The **deep lymphatic nodes of the lower extremity** are, (1) one or two ANTERIOR TIBIAL, which are placed beside the anterior tibial artery on the upper part of the interosseous membrane. (2) four or five POPLITEAL, which are placed around the popliteal vessels. (3) THE DEEP INGUINAL, which are placed under the deep fascia around the femoral vessels. These communicate with the superficial inguinal nodes through the saphenous opening. (4) THE GLUTEAL, which follow their corresponding vessels into the great sacro-sciatic foramen above the Pyriformis muscle. (5) ISCHIATIC which follow their corresponding vessels into the sacro-sciatic foramen below the Pyriformis muscle.

LESSON CLXV.

The **superficial lymphatic vessels of the pelvic and abdominal walls** pass with the superficial blood vessels. (1) THOSE BELOW THE UMBILICUS pass with the superficial epigastric vessels to the oblique set of the superficial inguinal nodes. (2) A DEEPER SET passes with the deep epigastric vessels to the external iliac nodes which form a chain around the external iliac blood vessels. Three of these nodes are found just behind the crural arch which communicates with the lumbar nodes above and with the inguinal nodes below. (3) THOSE FROM THE SIDES OF THE LUMBAR PART OF THE ABDOMINAL WALL pass with the superficial iliac blood vessels to the oblique set of the superficial inguinal nodes, but most of them pass with the ilio-lumbar and lumbar blood vessels to the lateral lumbar nodes. (4) THOSE OF THE GLUTEAL REGION pass around the outer side of the nates to end in the superficial inguinal nodes. (5) THOSE OF THE SCROTUM AND PERINEUM pass with the external pudic vessels to end in the superficial inguinal nodes. (6) THOSE OF THE PENIS end in the superficial inguinal nodes. (7) THOSE WHICH DRAIN THE MUCOUS MEMBRANE OF THE LABIA, NYMPHÆ, and CLITORIS in the female end in the oblique set of the superficial nodes.

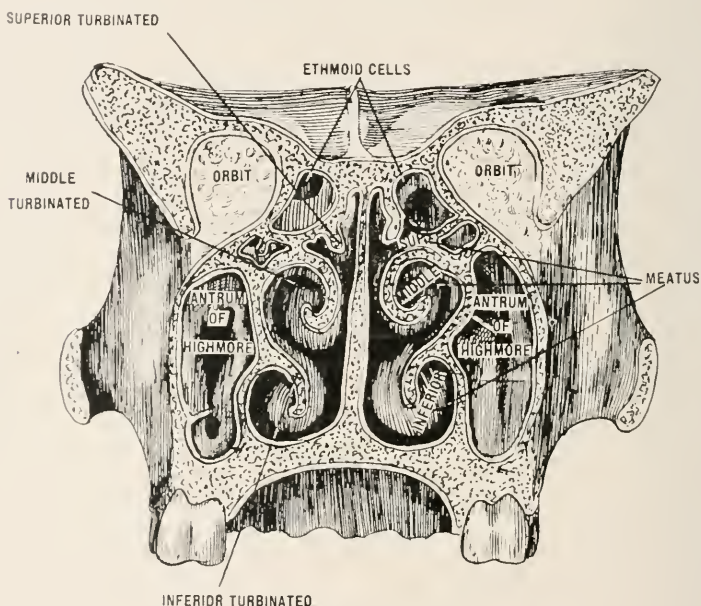
The **deep lymphatic vessels of the pelvic and abdominal walls** pass with the chief blood vessels and are, (1) THOSE WHICH ACCOMPANY THE GLUTEAL VESSELS, (2) THOSE WHICH ACCOMPANY THE ISCHIATIC VESSELS, (3) THOSE WHICH

ACCOMPANY THE OBTURATOR VESSELS. All these pass with the internal iliac artery to join the lumbar nodes. (4) THOSE OF THE PENIS pass with the internal pudic vessels to join the internal iliac nodes.

The **lymphatic vessels of the bladder** pass through its nodes on the posterior surface and join the lymphatic vessels from the prostate gland and seminal vesicles pass into the internal iliac nodes which surround the internal iliac blood vessels. These nodes receive radicles corresponding to the branches of the internal iliac artery and they communicate with the lumbar nodes.

The **lymphatic vessels of the rectum** pass through nodes on its outer wall and in the meso-rectum. They empty into the sacral nodes which occupy the sides and front of the sacrum in the meso-rectal fold.

PLATE CCLXIV.



THE MEATUSES.

The **lymphatic vessels of the uterus** are, (1) **SUPERFICIAL ONES** which are situated under the peritoneum and (2) **DEEP ONES** situated in the substance of the uterus. Those from the vagina and from the cervix pass into the sacral nodes and internal iliac nodes, while these from the body and fundus pass into the broad ligament to join those from the ovaries, broad ligaments, and Fallopian tubes to pass with the ovarian vessels to the lumbar nodes. These **lumbar nodes** are situated around the common iliac vessels, the aorta, and inferior vena cava on the front of the lumbar vertebrae. They receive vessels from the lower extremities, pelvis, testes, and some of the abdominal viscera. They unite with the lacteals to help form the thoracic duct. The **lateral lumbar nodes** are situated between the transverse processes of the vertebrae behind the

Psoas magnus muscle and help to drain the spinal canal, posterior and lateral abdominal walls.

The **lymphatic vessels of the testicle** are, (1) **SUPERFICIAL** which are from the surface of the tunica vaginalis, and (2) **DEEP ONES** which are from the epididymis and body of the testis. They empty into the lumbar nodes.

The **lymphatic vessels of the kidney** are, (1) **SUPERFICIAL** and (2) **DEEP**. These two vessels unite at the hilum to join the vessels from the ureter and suprarenal capsule. They end in the lumbar nodes.

The **lymphatic vessels of the stomach** are two sets, (1) **SUPERFICIAL ONES** in the subserous coat and (2) **DEEP ONES** in the submucous coat. The vessels which drain both surfaces of the stomach pass along the lesser curvature to end in nodes at the pyloric end of the stomach. Those which drain the fundus pass to the splenic nodes and those which pass along the greater curvature of the stomach join lacteals at the root of the mesentery.

The **lymphatic nodes of the stomach** lie within the lesser omentum and around the cardiac and pyloric orifices along the curvatures of the stomach.

The **lymphatic vessels of the spleen** are, (1) **SUPERFICIAL** which lie under its peritoneum, and (2) **DEEP** which lie in its substance. They end in the thoracic duct after receiving the pancreatic lymphatic vessels.

The **nodes of the spleen** are situated in its hilum.

The **lymphatic vessels of the small intestine** are called lacteals and are, (1) **SUPERFICIAL** which are placed between the layers of the muscular coat, or between the muscular and peritoneal coats. They run longitudinally. (2) **DEEP** which are situated in the submucous tissue and run transversely with the mesenteric vessels. These empty into the thoracic duct.

The **lymphatic nodes of the small intestine**, called mesentery nodes, lie between the layers of the mesentery, and they are about one hundred and fifty in number. They vary in size from that of a pea to that of a small almond, and the largest ones are situated near the duodenum and the ilio-cæcal valve. In these positions they are also more numerous.

The **lymphatic vessels of the large intestine** are in two sets, (1) **THOSE** of the cæcum, ascending colon, and transverse colon which pass to the mesenteric nodes, and (2) **THOSE** of the descending colon, sigmoid flexure, and rectum which pass to the lumbar nodes.

The **lymphatic nodes of the large intestine** are not so numerous as those of the small intestine and are very few along the transverse colon. They are situated upon the intestine itself or along the vascular arches of the arteries.

LESSON CLXVI.

The **lymphatic vessels of the liver** are in two sets, (1) **THE SUPERFICIAL SET** which lie in the subperitoneal areolar tissue, and on the convex surface of the liver. Those vessels on the convex surface of the liver are divided into the following groups, (a) those branches which run forward and then upward in the broad ligament pass through the Diaphragm to the anterior mediastinal nodes. These anterior mediastinal nodes are situated on the Diaphragm in front of the

pericardium and around the great vessels at the base of the heart. The vessels from the liver just mentioned which pass through these mediastinal nodes pass into the right lymphatic duct. (b) Those vessels which run around the anterior margin to the under surface of the liver pass to nodes in the lesser omentum. (c) Those branches which pass outward to the right lateral ligament pass either through the Diaphragm to the anterior mediastinal nodes or across the crus of the Diaphragm to the anterior mediastinal nodes or across the crus of the Diaphragm into the thoracic duct. (d) Those branches which run outward from the left lobe to the left lateral ligament and then through the Diaphragm to the anterior mediastinal nodes. Those **superficial lymphatic vessels** which are on the under surface of the liver form the following groups, (a) those branches which arise to the right of the gall bladder pass to the lumbar nodes, (b) those branches surrounding the gall bladder pass to the nodes in the lesser omentum, and (c) those branches arising to the left of the gall bladder pass either to the œsophageal nodes or to nodes along the lesser curvature of the stomach.

THE DEEP LYMPHATIC VESSELS OF THE LIVER pass with the branches of the portal vein, hepatic artery, and hepatic duct into the substance of the liver. They pass from the liver at the transverse fissure to enter nodes which are placed along the lesser curvature of the stomach and behind the pancreas. Or they may join a lacteal before entering the thoracic duct.

The **superficial lymphatic vessels of the thoracic wall** pass across the Trapezius and Latissimus dorsi muscles behind and the Pectoralis major muscle in front to end in the axillary nodes. Most of those from the mammary gland pass to small nodes which are situated along the lower border of the Pectoralis major muscle in the axilla, however, a few from the inner side of mammary gland pass through the intercostal spaces to the anterior mediastinal nodes.

The **deep lymphatic vessels of the thoracic wall** are, (1) INTERCOSTAL VESSELS which drain the Intercostal muscles and pleura. These join vessels from the back of the thorax and spinal canal which entering the intercostal nodes descend on the spine to the thoracic duct. The intercostal nodes which are small, lie on each side of the spine near the costo-vertebral articulation, and some of those lying between the Intercostal muscles. (2) THE INTERNAL MAMMARY which begin on the abdominal muscles above the umbilicus where they communicate with the epigastric. They pass upward through the Diaphragm where they are joined by the intercostal lymphatic vessels to empty into the right lymphatic duct on the right side, while those on the left side empty into thoracic duct. (3) THE LYMPHATIC VESSELS of the Diaphragm empty into the anterior mediastinal and internal mammary nodes anteriorly, and into the intercostal and posterior mediastinal nodes posteriorly.

The **internal mammary nodes** lie at the anterior end of each intercostal space near the internal mammary vessels.

The **posterior mediastinal nodes** lie along the aorta and œsophagus, and communicate with the intercostal nodes, lumbar nodes, and deep cervical nodes.

The **superficial lymphatic vessels of the lung** form a minute plexus which covers the outer surface of the lung under the pleura, while the deep lymphatic

vessels run with the blood vessels along the bronchi. The lymphatics of the lung empty into the bronchial nodes, which lie around the bifurcation of the trachea and the root of the lung. Several efferent vessels pass from these nodes to the tracheal nodes and œsophageal nodes at the root of the neck, and those on the right side empty into the right lymphatic duct, while those on the left side empty into the thoracic duct.

The **superficial cardiac lymphatic** vessels lie on the surface of the heart in the subserous or areolar tissue, while the deep cardiac lymphatic vessels lie in the deeper tissues. These vessels accompany the coronary vessels. Those of the right side uniting at the root of the aorta from which place they pass upward over the arch of the aorta along the trachea to the right lymphatic duct. Those of the left side unite at the base of the heart and pass along the pulmonary artery to nodes at the root of the aorta, and after ascending along the trachea pass into the thoracic duct.

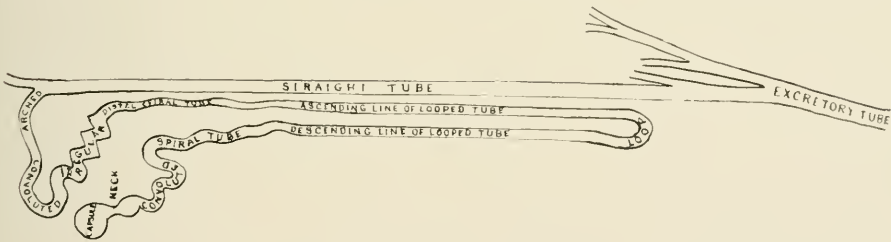
The **thymic vessels** pass into the internal jugular veins from the under surface of the thymus gland.

The **lymphatics of the œsophagus**, after communicating with the posterior mediastinal nodes, end in the thoracic duct.

LESSON CLXVII.

The **superficial lymphatic vessels of the scalp** are as follows: (1) **POSTERIOR OR OCCIPITAL VESSELS** which follow the course of the superficial veins

PLATE CCLXV.



THE URINIFEROUS TUBULES.

downward over the occipital bone to the occipital nodes. These nodes are also called suboccipital and are situated just below the superior line curved of the occipital bone. Their radicles are from the back of the head, and the vessels from these nodes empty into the superficial lymphatic nodes of the neck. In secondary syphilis these nodes are enlarged. (2) **POSTERIOR AURICULAR** (postero-lateral) vessels pass downward behind the ear to end in the postero-auricular nodes, also called Sterno-mastoid. These nodes are situated over the insertion of the Sterno-cleido-mastoid muscle. The vessels which leave these nodes empty into the superficial cervical. (3) **TEMPORAL LYMPHATIC VESSELS**, also called antero-lateral, pass with the superficial temporal vein and end in the parotid lymphatic nodes. These nodes are situated over the parotid gland

and some of them are in the substance of the parotid gland. Their radicles drain part of the temple, external parts of the eye lid, and the posterior part of the cheek. The vessels which leave these nodes empty into (a) submaxillary nodes, (b) some of them in the superficial cervical nodes. (4) AN ANTERIOR or frontal set pass over the frontal bone and empty into the buccal and submaxillary nodes. The buccal lymphatic nodes are situated on the surface of the Buccinator muscle.

The **superficial lymphatic vessels of the face** end in the submaxillary lymphatic nodes. These nodes are situated beneath the body of the lower jaw in the submaxillary triangle of the neck. There are eight to twelve of these nodes. Their radicles are, (1) FROM THE UPPER AND LOWER LIPS AND SIDE OF NOSE, (2) FROM THE FLOOR OF THE MOUTH, (3) FROM FRONT PART OF TONGUE, (4) FROM SUBLINGUAL AND SUBMAXILLARY SALIVARY GLANDS, and (5) FROM THE ANTERIOR PART OF THE CAROTID LYMPHATIC NODES. The vessels that leave these nodes empty into the deep cervical lymphatic nodes and also into the superficial lymphatic nodes.

The **suprahyoid lymphatic nodes** are two or three in number and are situated in the median line between the anterior bellies of the Digastric muscles.

The **superficial lymphatic vessels of the neck** join the superficial lymphatic vessels of the scalp and face and upper part of the thorax. They empty into the superficial cervical lymphatic nodes. These nodes are situated between the Platysma myoides muscle and the deep fascia along the course of the external jugular vein. Small lymphatic nodes are found anterior to these between the hyoid bone and the sternum, also posteriorly over the Trapezius muscle. The radicles of these superficial cervical nodes are, (1) THOSE FROM THE OCCIPITAL NODES, (2) THOSE FROM THE POSTERIOR AURICULAR NODES, (3) SOME FROM THE PAROTID AND SUBMAXILLARY NODES, (4) FROM THE INTEGUMENT OF THE NECK AND EXTERNAL EAR. The vessels passing from these nodes end in the deep cervical lymphatic nodes.

LESSON CLXVIII.

The **deep lymphatic vessels of the head and neck** follow the course of the deep arteries and end in the deep cervical chain of lymphatic nodes. They are as follows: (1) MENINGEAL LYMPHATIC VESSELS which pass with the meningeal arteries through foramina at the base of the skull to end in deep cervical nodes. (2) CEREBRAL LYMPHATICS, which pass with the internal carotid artery, vertebral artery, and internal jugular vein through foramina at the base of the skull to join the deep lymphatic nodes. (3) LYMPHATIC VESSELS OF THE ORBIT follow the inferior orbital vein into the spheno-maxillary fossa and from here they follow the internal maxillary vein and empty into the internal maxillary nodes and deep carotid nodes. (4) THE LYMPHATIC VESSELS FROM THE TEMPORAL FOSSA AND ZYGOMATIC FOSSA pass through the internal maxillary nodes to join the deep cervical nodes. (5) LYMPHATIC VESSELS FROM THE INFERIOR OF THE NOSE end in the lymphatics of the pharynx and into the deep cervical nodes. They communicate with the subdural lymph space and the subarachnoid lymph

space by means of the lymph spaces which surround the olfactory nerves. (6) **LYMPHATIC VESSELS OF THE MOUTH AND TONGUE.** Those from the floor of the mouth pass into the submaxillary lymphatic nodes after passing through the Mylo-hyoid muscle. Those from the lips pass into both the submaxillary and into the deep cervical nodes. Those deeply situated in the cheek and in roof of mouth join the internal maxillary lymphatic nodes. Those on the tongue pass with the ranine vein and empty into the deep cervical nodes, after passing through small lingual nodes in the Hyo-glossus muscle. Lymphatic vessels of the front part of the tongue pass into the submaxillary nodes after passing through the Mylo-hyoid muscle. (7) **THE LYMPHATIC VESSELS OF THE PHARYNX** empty into the deep cervical nodes, but those from the upper part of the pharynx first pass through the post-pharyngeal node. Lymphatic vessels of the tonsil empty into the submaxillary nodes. (8) **THE LYMPHATICS OF THE LARYNX** empty into the deep cervical nodes. (9) **THE LYMPHATICS VESSELS OF THE UPPER PART OF THE ŒSOPHAGUS AND TRACHEA** open into the deep cervical nodes. (10) **THE LYMPHATICS OF THE THYROID GLAND** open into the deep cervical nodes.

The deep lymphatic nodes of the head are. (1) **THE LINGUAL**, which are situated on the outer surface of the Hyo-glossus and Genio-hyo-glossus muscles. There are two to four in number and collect the lymph from the upper surface and posterior part of the substance of the tongue. The vessels from these nodes empty into the superior nodes of the deep cervical nodes. (2) **THE INTERNAL MAXILLARY** or deep facial nodes are situated behind the Buccinator muscle and are three to six in number. Their radicles are from (a) the orbit, (b) the nose, (c) the temporal and speno-maxillary fossæ, (d) the upper jaw, (e) the palate, (f) the pharynx. The vessels from these nodes empty into the superior nodes of the deep cervical nodes. (3) The post-pharyngeal node is situated near the base of the skull on the Rectus capitis anticus major muscle. Its radicles are from (a) the pharynx, (b) nose, (c) the deep prevertebral muscles.

The deep lymphatic nodes of the neck are. (1) **AN UPPER SET** which passes along the internal jugular vein as far as the thyroid cartilage. This set of nodes receives radicles from the (a) inferior of the cranium, (b) from the deep muscles of the upper part of the neck, (c) from the internal maxillary glands, (d) from the posterior half of the tongue, (e) from the middle portion of the pharynx, (f) the upper part of the larynx, (g) the upper part of the thyroid gland, (h) and some of the vessels from the submaxillary nodes. Vessels from these nodes pass downward to the lower deep cervical nodes. (2) **A LOWER SET** which follows the internal jugular vein from the thyroid cartilage to near its termination. These receive radicles from (a) the lower part of the neck, (b) the upper set of lymphatic nodes, (c) the lower part of the larynx, (d) lower part of thyroid gland, (e) the upper part of the Œsophagus and trachea, (f) from the superficial cervical nodes. The vessels which leave these nodes end in the jugular lymphatic trunk which unites with the subclavian lymphatic trunk to form the right lymphatic trunk on the right side and the thoracic duct on the left side.

LESSON CLXIX.

FRONTAL BONE. (Plates CCXXXVII-CCXXXVIII.)

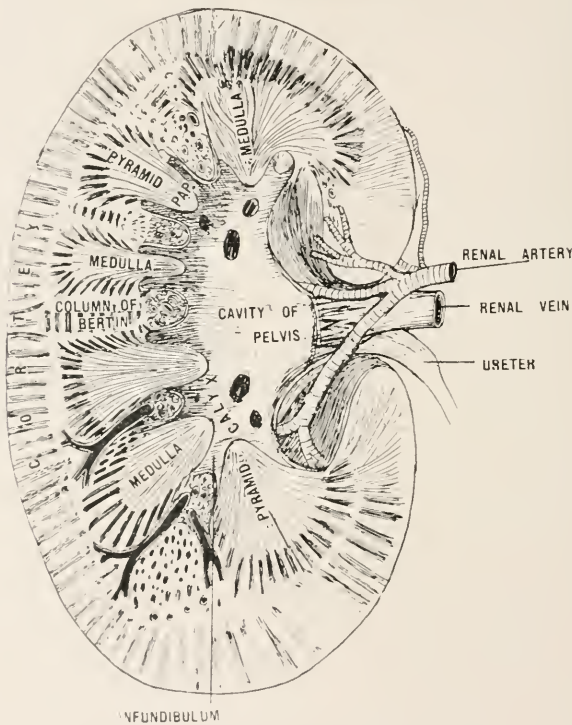
The **frontal bone** consists of two main parts, a VERTICAL or FRONTAL PORTION which forms the forehead, and a HORIZONTAL or ORBITO-NASAL PORTION which forms the roofs of the orbits and nasal fossæ.

The **external surface** of the vertical portion has the following points for consideration:

1. THE METOPIC SUTURE (present in the young) is situated in the middle of the frontal bone. (Plate CCXXXVIII.)

2. THE FRONTAL EMINENCE is just below the center of the bone externally from the mid-line.

PLATE CCLXVI.



SAGITTAL SECTION OF THE KIDNEY.

3. THE ARCHED SUPERCILIARY RIDGE is below the frontal eminence and separated from it by a groove. This ridge, which is produced by the frontal sinus, is more distinct internally.

4. THE GLABELLA or nasal eminence is between the superciliary ridges and is continuous with them.

5. THE SUPRAORBITAL ARCH is the upper margin of the orbit and separates the vertical and horizontal portions of the frontal bone.

6. THE SUPRAORBITAL NOTCH or foramen is at the junction of the inner and middle thirds of this arch. It transmits the supraorbital vessels and nerve

and at this point a small vein from the diploe passes into the supraorbital vein.

7. THE EXTERNAL ANGULAR PROCESS is the end of the supraorbital arch and is well marked. It articulates with the malar bone.

8. THE INTERNAL ANGULAR PROCESS is the other end of the supraorbital arch and is not so well marked as the external angular process. It articulates with the lachrymal bone.

9. THE TEMPORAL RIDGES run upward and backward from the external angular process. The lower ridge gives attachment to the Temporal muscle, and the upper one gives attachment to the temporal fascia.

10. THE ANTERIOR PART OF THE TEMPORAL FOSSA is below these ridges and gives origin to part of the Temporal muscle.

11. THE NASAL NOTCH is between the internal angular processes and articulates with the two nasal bones mesially and with the nasal process and the superior maxillary bone externally.

12. THE NASAL PROCESS passes from this notch under the nasal bones and the nasal processes of the superior maxillary bones.

13. THE NASAL SPINE arises from the under surface of the nasal process and joins the nasal bones in front and the perpendicular plate of the ethmoid behind to form part of the septum.

The **internal surface** of the vertical portion has the following points for consideration :

1. A VERTICAL GROOVE which passes along the middle line for the superior longitudinal sinus, and the edges of this groove give attachment to the falx cerebri.

2. THE FRONTAL CREST is formed by the edges of this groove uniting anteriorly.

3. THE FORAMEN CÆCUM is formed by a notch in the lower end of the frontal crest by its articulation with the ethmoid. This foramen lodges a process of the falx cerebri, and when open a vein from the nose passes through it to the superior longitudinal sinus.

4. EMINENCES AND DEPRESSIONS are found on this surface of the frontal bone external to the median line for the cerebral convolutions.

5. FURROWS which are for branches of the anterior meningeal arteries.

6. DEPRESSIONS for the Pacchionian bodies are near the vertical groove.

The **frontal sinuses** are two spaces at the anterior inferior part of the bone between its layers. They are lined with mucous membrane and open into the middle meatus of the nose by the infundibula.

The **inferior surface** of the horizontal portion has the following points for consideration :

1. THE ETHMOID NOTCH separates two thin plates which forms the vault of each orbit. This notch is filled by the cribriform plate of the ethmoid, and edges of this notch present half cells which with half cells of the ethmoid make the ethmoidal cells.

2. THE LACHRYMAL FOSSA, which is for the lachrymal gland, is near the external angular process.

3. A DEPRESSION or tubercle for the fibrous pulley of the Superior oblique muscle is at the nasal margin of this surface.

4. **ANTERIOR ETHMOIDAL FORAMEN** is for the anterior ethmoidal vessels and nasal branch of the ophthalmic nerve.

POSTERIOR ETHMOIDAL FORAMEN is for the posterior ethmoidal vessels.

The **superior surface** of the horizontal portion is convex and has depressions and eminences for the frontal convolutions, also grooves for branches of the anterior and middle meningeal arteries.

OSSIFICATION.—This bone has two centers of ossification, one for each half.

ARTICULATION.—It articulates with the following bones: (1) the two parietal, (2) the sphenoid, (3) the ethmoid, (4) two nasal, (5) two superior maxillary, (6) two lachrymal, (7) two malar, thus making twelve bones.

ATTACHMENT OF MUSCLES.—It has three pairs of muscles attached to it. (1) *Corrugator supercilii*, (2) *Orbicularis palpebrarum*, (3) *Temporal*.

BLOOD SUPPLY.—The middle and small meningeal arteries on the cerebral surface and the frontal and supraorbital on the outer surface. The ethmoidal arteries and other branches of the ophthalmic artery pass to the horizontal plate.

Corrugator supercilii.—**DESCRIPTION.**—This muscle, which is situated beneath the Occipito-frontalis and *Orbicularis palpebrarum* at the inner end of the superciliary ridge, is small and pyramidal.

ORIGIN.—From inner end of the superciliary ridge of temporal bone.

INSERTION.—Into the deep surface of the skin opposite the middle of the supraorbital arch.

ACTION.—To draw the eye brow downward and inward, which produces the vertical wrinkles in the forehead.

NERVE SUPPLY.—Temporal branch of the facial nerve, or by fibers of the third nerve which join this nerve.

BLOOD SUPPLY.—Supra-orbital and frontal from ophthalmic artery.

Orbicularis palpebrarum.—**DESCRIPTION.**—This muscle, which surrounds the circumference of the orbit and eye lids, consists of an orbicular portion and a palpebral portion.

ORIGIN OF ORBICULAR PORTION.—(1) From internal angular process of the frontal bone, (2) nasal process of superior maxillary bone, (3) borders and anterior surface of the *tendo oculi*.

INSERTION.—Into the skin of the eye lids, forehead, temple, and cheek, its upper fibers blending with the Occipito-frontalis and the *Corrugator supercilii*.

ORIGIN OF PALPEBRAL PORTION.—From the bifurcation of the *tendo oculi*. This portion is thinner and paler than the other portion.

INSERTION.—Into a raphe on the outer side of the eye lids, the external tarsal ligament, and malar bone.

ACTION.—To close the eye lids.

NERVE SUPPLY.—Temporal branch of facial nerve or by fibers of the third nerve which join this nerve.

BLOOD SUPPLY.—Supra-orbital, frontal from ophthalmic, and branches from the temporal.

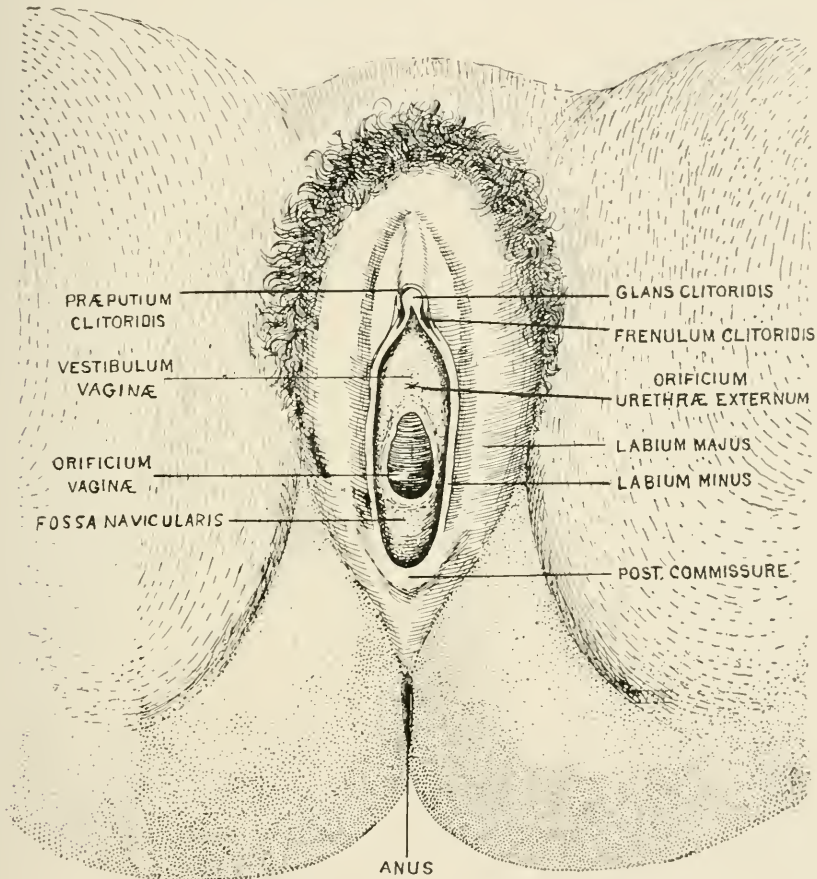
Temporal.—**DESCRIPTION.**—This is a large and radiating muscle situated in the temporal fossa.

ORIGIN.—(1) From temporal ridge, (2) temporal fascia. (3) greater part of the temporal fossa.

INSERTION.—Into the inner surface, apex and anterior border of the coronoid process of the inferior maxillary bone.

ACTION.—To bring the incisor teeth together. It is called the biting muscle.

PLATE CCLXVII.



THE FEMALE EXTERNAL ORGANS OF GENERATION.

NERVE SUPPLY.—Temporal branches of the inferior maxillary division of the fifth nerve.

BLOOD SUPPLY.—Muscular branches from the second portion of the internal maxillary artery.

LESSON CLXX.

THE PARIETAL BONE. (Plates CCXXXIX-CCXL)

The **parietal bone** has two SURFACES, four BORDERS, and four ANGLES for consideration.

The **external surface** of the parietal bone has the following points:

1. **PARIETAL EMINENCE** near the center of the bone where ossification commences.
2. **TWO SEMICIRCULAR TEMPORAL RIDGES** which are about two-fifths of an inch apart and are continuous with the ridges on the frontal bone, and like those on the frontal bone give attachment to the Temporal muscle and to the temporal fascia.
3. **THE SURFACE BELOW THESE RIDGES** gives attachment to part of the Temporal muscle.
4. **THE PARIETAL FORAMEN** is near the superior border and transmits a vein to the superior longitudinal sinus. Occasionally a branch of the occipital artery passes through this foramen. This foramen is inconstant.

The **internal surface** of the parietal bone is concave and has the following points:

1. **EMINENCES AND DEPRESSIONS** for the cerebral convolutions.
2. **FURROWS** for the middle meningeal artery.
3. **A GROOVE**, which with its fellow, lodges the superior longitudinal sinus. There is also a groove for the lateral sinus at the posterior inferior angle.

THE SUPERIOR BORDER is dentated and with its fellow forms a sagittal suture, which is a synarthrosis joint. This border is the longest and thickest of the four borders.

THE ANTERIOR BORDER joins the frontal bone and helps to form the coronal suture.

THE POSTERIOR BORDER joins the occipital bone and helps to form the lambdoid suture.

THE INFERIOR BORDER is divided into the following parts, (a) the anterior, which is overlapped by the tip of the greater wing of the sphenoid, (b) the middle part which is overlapped by the squamous portion of the temporal bone, and (c) the posterior part which articulates with the mastoid process of the temporal bone.

THE ANTERIOR SUPERIOR ANGLE is the point where the two parietal bones meet the frontal bone. This is the location of the anterior fontanelle which is called the soft spot in the baby's head.

THE POSTERIOR SUPERIOR ANGLE is the point where the two parietal bones and the occipital bone meet. This is the location of the posterior fontanelle.

THE POSTERIOR INFERIOR ANGLE joins the mastoid process of the temporal bone.

THE ANTERIOR INFERIOR ANGLE joins the frontal bone and greater wing of the sphenoid bone.

OSSIFICATION.—This bone ossifies from one center.

ARTICULATION.—It articulates with, (1) the opposite parietal bone, (2) the occipital bone, (3) the frontal, (4) the temporal, and (5) the sphenoid, thus making five bones.

ATTACHMENT OF MUSCLES.—This bone has but one muscle attached to it, the Temporal. See page 508

BLOOD SUPPLY.—Middle meningeal, occipital, supraorbital arteries.

LESSON CLXXI.

THE OCCIPITAL BONE. (Plates CCXLI-CCXLII.)

The **occipital bone** is situated at the posterior and inferior region of the cranium and is trapezoidal in form. This bone is curved upon itself.

The **external surface** is convex and has the following points for consideration:

1. THE **EXTERNAL OCCIPITAL PROTUBERANCE** is situated midway between the superior point of the bone and the foramen magnum. It gives attachment to the ligamentum nuchæ.

2. THE **EXTERNAL OCCIPITAL CREST** is a vertical ridge extending from the external occipital protuberance to the foramen magnum. This also gives attachment to the ligamentum nuchæ.

3. THE **SUPERIOR CURVED LINE** extends outward on each side from the external occipital protuberance. This line gives attachment to the Trapezius muscle internally and the Occipito-frontalis and Sterno-mastoid muscles externally.

4. THE **HIGHEST CURVED LINE** (linea suprema) is above the superior curved line and gives attachment to epicranial aponeurosis.

5. THE **INFERIOR CURVED LINE**, which passes outward from the middle of the external occipital crest together with a depression below it, gives attachment to the Rectus capitis posterior major and Rectus capitis posterior minor.

6. THE **DEPRESSION** between the superior and inferior curved lines gives attachment to the Complexus muscle internally, Splenius capitis and Superior oblique externally.

7. THE **FORAMEN MAGNUM** is a large oval opening near the inferior angle. Its greatest diameter is antero-posteriorly. It transmits the following structures: (a) the medulla and its membranes, (b) the spinal accessory nerve, (c) the occipito-axial ligaments, (d) vertebral arteries, (e) anterior and posterior spinal arteries.

8. THE **CONDYLES** are situated on each side of the anterior part of the foramen magnum. They are convex and reniform in shape. They look backward and outward to articulate with the atlas.

9. THE **TUBERCLES** are situated on the inner border of each condyle and give attachment to the check ligaments.

10. THE **JUGULAR PROCESSES** (transverse) are situated externally to the condyles, and help to form the posterior lacerated foramen.

11. THE **JUGULAR FORAMEN** is on the anterior border of the jugular process.

12. A **QUADRILATERAL FACET** is on the external surface of the jugular process for its articulation with the petrous portion of the temporal bone.

13. A **DEEP GROOVE** is on the upper surface of the jugular process for the lateral sinus.

14. AN **EMINENCE** (paramastoid in animals), which may extend to the transverse process of the atlas, gives attachment to the Rectus capitis lateralis muscle and the lateral occipito-atlantal ligament.

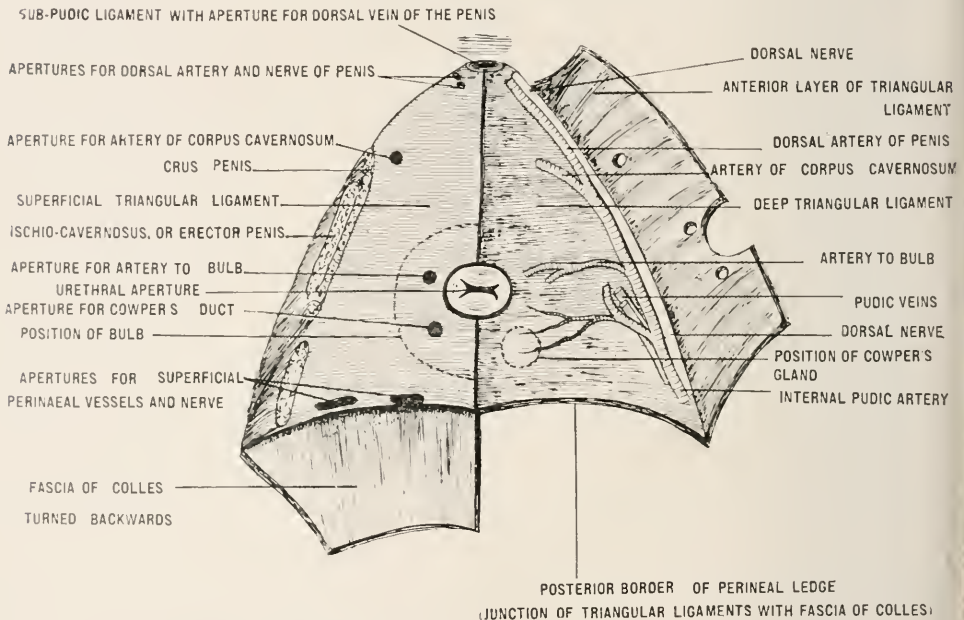
15. **ANTERIOR CONDYLOID FORAMEN** is on the outer side of each condyle. It

transmits the hypoglossal nerve and some meningeal branches. This foramen may be double.

16. **POSTERIOR CONDYLOID FORAMEN**, which is behind the condyle, transmits a vein to the lateral sinus. It is at the bottom of the posterior condyloid fossa and is often absent.

The **basilar process** of the occipital bone is situated anterior to the foramen magnum and is quadrilateral in shape. The pharyngeal spine (sagittal ridge) is on its under surface and gives attachment to the tendinous raphe and the Superior constrictor muscle. There is a depression on each side of this spine

PLATE CCLXVIII.



COLLES' FASCIA AND THE TRIANGULAR LIGAMENTS OF PERINEUM.

for the attachment of the Rectus capitis anticus major and Rectus capitis anticus minor.

The **internal** or **cerebral surface** of the occipital bone is deeply concave and has the following points for consideration:

1. **FOUR FOSSÆ** are formed by a crucial ridge. The inferior of these fossæ are for the cerebellum and the superior ones are for the cerebrum.

2. **THE INTERNAL OCCIPITAL PROTUBERANCE** lies at the junction of the divisions of the ridges. It is the point where the six cranial sinuses meet to form the torcular Herophili.

3. **CRUCIAL RIDGE** has a vertical portion which is for the falx cerebri (above) and the falx cerebelli (below); and a transverse portion for the tentorium cerebelli.

4. **GROOVES** are present between the attachment of the dura mater for the sinuses.

5. THE INTERNAL OPENINGS for the anterior condyloid foramina and posterior condyloid foramina are seen on each side of the foramen magnum.

The **basilar process** of the occipital bone on its inner surface has a median groove for the medulla and the pons, and on each side of this groove there is a narrow groove which joins another groove from the petrous portion of the temporal bone to receive the inferior petrosal sinus.

THE SUPERIOR ANGLE is a point where the occipital bone meets the two parietal bones. This is the position of the posterior fontanelle.

EACH LATERAL ANGLE is the point where the occipital bone meets the posterior inferior angle of the parietal bone and the mastoid part of the temporal bone.

THE INFERIOR ANGLE (basilar process) joins the body of the sphenoid bone.

THE SUPERIOR BORDER passes from one lateral angle to the superior angle and helps to form the lambdoid suture.

THE INFERIOR BORDER passes from the lateral angle to the inferior angle. The upper part of this border joins the mastoid bone and the lower part joins the petrous portion of the temporal bone.

LESSON CLXXII.

OSSIFICATION.—It has from four to eleven centers of ossification.

ARTICULATION.—It articulates with the two parietal, two temporal, sphenoid, and atlas, thus making six bones.

ATTACHMENT OF MUSCLES.—It has twelve pairs of muscles attached to it, (1) THOSE TO THE SUPERIOR CURVED LINE are Occipito-frontalis of the frontal region, Trapezius of the first layer of the back, and Sterno-cleido-mastoid of the superficial cervical region.

2. TO THE SPACE BETWEEN THE CURVED LINES are the Complexus of the fourth layer of the back, Splenius capitis of the third layer of the back, and Superior oblique of the fifth layer of the back.

3. THOSE ATTACHED TO THE INFERIOR CURVED LINE AND THE SPACE BETWEEN IT AND THE FORAMEN MAGNUM are the Rectus capitis posticus major, and Rectus capitis posticus minor of the fifth layer of the back.

4. THAT ATTACHED TO THE TRANSVERSE PROCESS is the Rectus capitis lateralis of the anterior vertebral region.

5. THOSE ATTACHED TO THE BASILAR PROCESS are the Rectus capitis anticus major, and Rectus capitis anticus minor of the anterior vertebral region, and the Superior constrictor of the pharynx of the pharyngeal region.

BLOOD SUPPLY.—Occipital, posterior auricular, middle meningeal, vertebral, and ascending pharyngeal arteries.

Occipito-frontalis.—DESCRIPTION.—This muscle consists of an anterior portion called frontal, and a posterior portion called occipital, and a third portion which is between these two which is called the tendinous aponeurosis.

ORIGIN.—The occipital portion arises from the outer two-thirds or one-half of the superior curved line of the occipital bone and the mastoid process of the temporal bone. The frontal portion arises from the Pyramidalis nasi,

Corrugator supercilii, and Orbicularis palpebrarum muscles. A few fibers of this muscle may be attached to the nasal bone and the frontal bone.

INSERTION.—Into the tendinous aponeurosis of the vertex of the skull.

ACTION.—The frontal portion draws the scalp forward and raises the eye brows and skin over the root of the nose. The occipital portion draws the scalp backward. The Occipito-frontalis muscle is chiefly a muscle of facial expression.

NERVE SUPPLY.—The frontal portion receives the facial nerve or branches of the third nerve which join this nerve. The occipital portion receives the posterior auricular branch of the facial and sometimes the occipitalis minor.

BLOOD SUPPLY.—The frontal portion receives the supraorbital, frontal, and anterior temporal arteries. The occipital portion receives the occipital and posterior auricular arteries.

Trapezius muscle. For description of this muscle see page 45.

Sterno-cleido-mastoid. For description of this muscle see page 40.

Complexus. For description of this muscle see page 275.

Splenius capitis. For description of this muscle see page 272.

Superior oblique. For description of this muscle see page 278.

Rectus capitis posticus major. For description of this muscle see page 278.

Rectus capitis posticus minor. For description of this muscle see page 278.

Rectus capitis lateralis.—**DESCRIPTION.**—This muscle belongs to the anterior vertebral region.

ORIGIN.—From the upper surface of the transverse process of the atlas.

INSERTION.—Into the under surface of the jugular process of the occipital bone.

ACTION.—To draw the head laterally.

NERVE SUPPLY.—First cervical nerve and a loop between it and the second.

BLOOD SUPPLY.—Prevertebral branches of ascending pharyngeal artery.

Rectus capitis anticus major.—**DESCRIPTION.**—This muscle belongs to the anterior vertebral region, and looks as though it were a continuation upward of the Scalenus anticus. It is narrow below but broad and thin above. Behind it are the Longus colli and Rectus capitis anticus minor muscles. In front of it is the sympathetic nerve.

ORIGIN.—From the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebrae. As it passes upward it converges towards its fellow.

INSERTION.—Into the basilar process of the occipital bone.

ACTION.—To flex and rotate the head, and to restore it to its natural position after being drawn backward.

NERVE SUPPLY.—First cervical and a loop between it and the second cervical nerve.

BLOOD SUPPLY.—Prevertebral branches of ascending pharyngeal.

Rectus capitis anticus minor.—**DESCRIPTION.**—This muscle, which is short, lies immediately behind the Rectus capitis anticus major and in front of the occipito-atlantal articulation. Its course is obliquely upward and inward.

ORIGIN.—From the anterior surface of the lateral mass of the atlas, and from the root of its transverse process.

INSERTION.—Into the basilar process immediately behind the Rectus capitis anticus major.

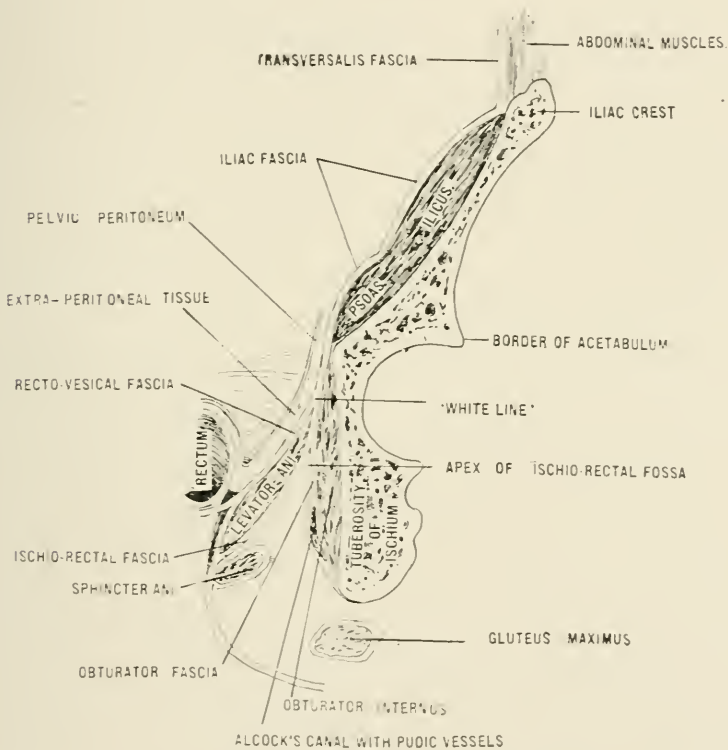
ACTION.—Same as the Rectus capitis anticus major.

NERVE SUPPLY.—Same as Rectus capitis anticus major.

BLOOD SUPPLY.—Prevertebral branches of the ascending pharyngeal.

Superior constrictor.—**DESCRIPTION.**—This muscle, which is situated at the upper part of the pharynx, is of a quadrilateral shape and thinner and paler

PLATE CCLXIX.



THE WHITE LINE AND ISCHIO-RECTAL FOSSA.

than the other Constrictor muscles. Its superior fibers pass beneath the Levator palati muscle and the Eustachian tube. Between the upper border of this muscle and the basilar process this muscle is deficient in fibers and closed by the pharyngeal aponeurosis. This interval is known as the sinus of Morgagni.

ORIGIN.—(1) From the lower one-third of the posterior margin of the internal pterygoid plate, (2) its hamular process, (3) the contiguous portion of the palate bone, (4) the reflected tendon of the Tensor palati muscle, (5) the pterygo-maxillary ligament, (6) the alveolar process above the posterior extremity of the mylo-hyoid ridge, (7) a few fibers from the side of the tongue.

INSERTION.—Into the median raphe of the pharynx and to the pharyngeal spine of the basilar process of the occipital bone by fibrous aponeurosis.

ACTION.—To constrict the pharynx.

NERVE SUPPLY.—Branches from the pharyngeal plexus.

BLOOD SUPPLY.—It receives its blood supply from the blood supply to the pharynx which is (1) superior thyroid, (2) ascending pharyngeal from the external carotid, and (3) the pterygo-palatine and (4) descending palatine from the internal maxillary.

LESSON CLXXIII.

TEMPORAL BONE. (Plates CCLXVI-CCLXVII-CCLXVIII-CCLXIX.)

The **temporal bone** lies at the inferior lateral portion of the skull and consists of a squamous, mastoid, and petrous portion. It contains the organs of hearing.

The **squamous portion** (scale-like) forms the anterior superior part of the bone.

The **external surface** of the squamous portion is convex and has grooves on its posterior part for the deep temporal arteries. It has attached to it the Temporal muscle, and forms part of the temporal fossa. A part of the temporal ridge is situated between this portion of the bone and the mastoid portion.

The **zygomatic process** arises by three roots and extends forward to articulate with the malar bone. Its anterior root, which runs inward and ends in the eminentia articularis, is short and broad. Its middle root, also called postglenoid process, passes between the auditory process and the mandibular portion of the glenoid fossa. The posterior root passes upward and backward from the upper border of the zygoma and forms part of the temporal ridge (here called supramastoid crest.)

TO THE UPPER BORDER OF THE ZYGOMA is attached the temporal fascia, and to the lower border and concave inner surface is attached the Masseter muscle. The external lateral ligament of the lower jaw is attached to a tubercle at the anterior root of the zygoma. Between the anterior and middle roots of the zygoma is THE GLENOID FOSSA, the anterior or mandibular portion of which is for the articulation of the condyle of the lower jaw and is covered with cartilage, while its posterior part lodges the parotid gland. This posterior portion is formed chiefly by the tympanic plate which forms the antero-inferior wall of the external auditory meatus and ends externally in the auditory process. THE GLASERIAN FISSURE divides the glenoid fossa and transmits the tympanic branch of the internal maxillary artery and lodges the processus gracilis malleus. THE OPENING OF THE CANAL OF HUGIER is situated in the angle between the squamous portion and petrous portion of the temporal bone. It transmits the chorda tympana nerve.

The **internal surface** of the squamous portion is concave and has eminences and depressions for the cerebral convolutions, also grooves for the middle meningeal artery.

THE SUPERIOR BORDER of the squamous portion is thin and overlaps the parietal bone.

THE ANTERO-INFERIOR BORDER is thick and articulates with the greater wing of the sphenoid bone.

The **mastoid portion** of the temporal bone projects like a nipple from the inferior portion of the bone posteriorly.

The **outer surface** of the mastoid process has attached to it the Occipito-frontalis muscle near the Retrahens aurem. The mastoid foramen may be on this part of the bone but is often on the occipital bone. It transmits a vein to the lateral sinus and a meningeal branch of the occipital artery. There are numerous small foramina on this surface.

The **inner surface** of the mastoid process has a deep curved fossa for the lateral sinus. This process gives attachment to the following muscles. (1) Sterno-cleido-mastoid, (2) Splenius capitis, (3) Trachelo-mastoid, (4) Digastric, (5) Retrahens aurem, (6) Occipito-frontalis.

The **digastric fossa** is on the inner side of the mastoid process. The occipital groove, which is for the occipital artery, lies parallel to the digastric fossa internally to it. The mastoid cells are situated in the mastoid process and open into the tympanum. They are lined with mucous membrane. The upper ones are large, while the lower ones are small.

THE SUPERIOR BORDER of the mastoid portion articulates with the posterior angle of the parietal.

THE POSTERIOR BORDER articulates with the occipital bone between its jugular process and lateral angle.

The **petrous portion** of the temporal bone is of a pyramidal form and is situated between the sphenoid bone and the occipital bone. This portion of the bone is very dense and hard. It contains the internal and middle ear and passes forward and inward. It has a base, an apex, three surfaces, and three borders.

The **base** is situated against the squamous and mastoid portions, the lower half of this base can be seen between the divergence of the squamous and mastoid portions, but the upper half is concealed by them. The base presents the following points:

THE MEATUS AUDITORIUS EXTERNUS, which is the external opening of the ear. This opening lies in front of the mastoid process between the posterior root and middle root of the zygoma. The upper margin of this opening is smooth and belongs to the squamous portion of the temporal bone, but the rest of it belongs to the petrous portion of the temporal bone and forms the second point for consideration at the base of the petrous portion, namely, THE AUDITORY PROCESS which is for the attachment of the cartilage of the ear.

The **apex**, which lies internally at the base of the skull, is received between the greater wing of the sphenoid and the basilar process of the occipital bone, thus forming the outer boundary of foramen lacerum medium, and contains the internal carotid canal.

The **anterior surface** of the petrous portion of the temporal bone forms the back part of the middle fossa of the skull and is united with the squamous

portion by the temporal or petro-squamous suture. It has six points for consideration. (Plate CCXLVII.)

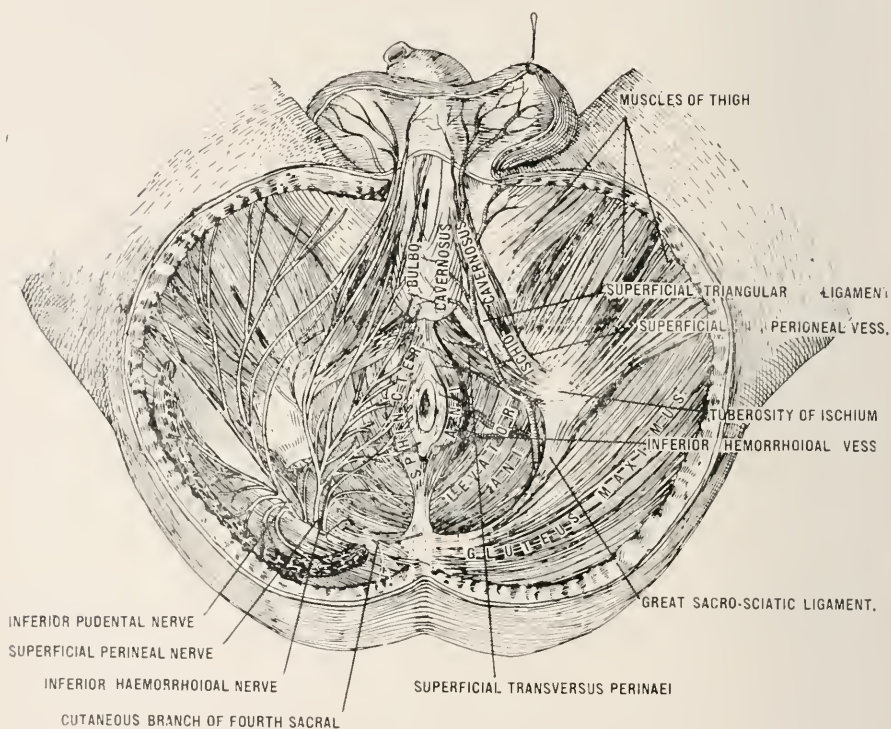
1. OPENING OF THE CAROTID CANAL, which is for the internal carotid artery and plexus, is situated near the apex.

2. A DEPRESSION for the Gasserian ganglion of the fifth nerve above the carotid canal.

3. HIATUS FALLOPII is a groove which runs outward and backward. This is for the great petrosal nerve and branches of the middle meningeal artery.

4. FORAMEN for the small petrosal nerve.

PLATE CCLXX.



SHOWING THE MUSCLES OF THE PERINEUM.

5. EMINENCE over the superior semicircular canal which is near the center of this surface.

6. A DEPRESSION external to the eminence over the tympanum.

The **posterior surface** of the petrous portion of the temporal bone forms the anterior part of the posterior fossa of the base of the skull and has the following points for consideration: (Plate CCXLVII.)

1. MEATUS AUDITORIUS INTERNUS, which is a short canal at the end of which is the lamina cribrosa. This lamina is perforated by branches of the seventh and eighth nerves, which pass into this opening.

2. OPENING OF THE AQUEDUCTUS VESTIBULI which is behind the meatus

auditorius internus. It transmits a small artery and vein and lodges a process of the dura mater.

3. AN ANGULAR DEPRESSION, which transmits a vein to the cancellous tissue and lodges a process of the dura mater, is between and above these other openings.

LESSON CLXXIV.

The **inferior surface** of the petrous portion of the temporal bone forms part of the base of the skull and from its apex to its base it has the following points for consideration: (Plate CCXLIX.)

1. A ROUGH QUADRILATERAL SURFACE for the origin of the Levator palati and Tensor tympani muscles.

2. OPENING OF THE CAROTID CANAL which ascends vertically into the bone and then turning runs horizontally forward and inward. It transmits the internal carotid artery and carotid plexus.

3. AQUEDUCTUS COCHLEAE, which transmits an artery and vein to and from the cochlea.

4. JUGULAR FOSSA is a depression for the sinus of the internal jugular vein, and with the occipital bone forms the foramen lacerum posterius, which transmits the internal jugular vein and the ninth, tenth, and eleventh cranial nerves.

5. FORAMEN FOR JACOBSON'S NERVE (tympanic branch of the glosso-pharyngeal) is in the ridge between the jugular fossa and the carotid canal.

6. FORAMEN FOR ARNOLD'S NERVE (auricular branch of the pneumogastric) is in the outer wall of the jugular fossa.

7. THE JUGULAR SURFACE is a smooth quadrilateral facet which articulates with the jugular process of the occipital bone.

8. VAGINAL PROCESS ensheaths the root of the styloid process and gives attachment to the Tensor palati muscle.

9. STYLOID PROCESS, which is about an inch long and runs downward, forward, and inward, and gives attachment to the stylo-hyoid, stylo-maxillary ligaments, and to the Stylo-pharyngeus, Stylo-hyoid, and Stylo-glossus muscles.

10. STYLO-MASTOID FORAMEN is between the styloid process and the mastoid process. It is the end of the aqueductus Fallopii and transmits the facial nerve, and the stylo-mastoid artery enters it.

11. THE AURICULAR FISSURE, which is between the auditory and mastoid processes, is for the exit of Arnold's nerve.

THE SUPERIOR BORDER of the petrous portion of the temporal bone is the longest and is grooved for the superior longitudinal sinus. It gives attachment to the tentorium cerebelli and has a notch at its inner end for the fifth nerve. It separates the middle fossa of the skull from the posterior fossa.

THE POSTERIOR BORDER of the petrous portion of the temporal bone has on its inner half a groove, which with a similar groove on the occipital bone lodges the inferior petrosal sinus. On the outer half of this border is a notch which forms part of the jugular foramen.

THE ANTERIOR BORDER of the petrous portion of the temporal bone is the

shortest and has an inner portion which articulates with the sphenoid bone, and an outer portion which joins with the squamous portion.

The **processus cochleariformis** is a thin plate of bone which separates two canals at the petro-squamous angle. The upper of these canals is for the Tensor tympani muscle, and the lower one for the Eustachian tube. They lead into the middle ear.

OSSIFICATION.—This bone ossifies from ten centers.

ARTICULATION.—It articulates with five bones; (1) the occipital, (2) parietal, (3) sphenoid, (4) inferior maxillary, (5) malar.

ATTACHMENT OF MUSCLES.—It has fifteen muscles attached to it:

1. To THE SQUAMOUS PORTION of the temporal bone, the Temporal muscle of the tempero-maxillary region.

2. To THE ZYGOMA, the Masseter muscle of the temporo-maxillary region.

3. To THE MASTOID PORTION, (a) the Occipito-frontalis of the cranial region, (b) Sterno-cleido-mastoid of the superficial cervical region, (c) Splenius capitis of the third layer of the back, (d) Trachelo-mastoid of the fourth layer of the back, (e) Digastric of the supra-hyoid region, (f) RetrAhens aurem of the auricular region.

4. To THE STYLOID PROCESS, (a) Stylo-pharyngeus of the pharyngeal region, (b) Stylo-hyoid of the supra-hyoid region, (c) Stylo-glossus of the lingual region.

5. To THE PETROUS PORTION, (a) Levator palati of the soft palate, (b) Tensor tympani of the tympanic region, (c) Stapedius of the tympanic region.

BLOOD SUPPLY.—The stylo-mastoid artery from the posterior auricular. It enters the stylo-mastoid foramen. The tympanic artery from the internal maxillary. It passes through the Glaserian fissure. Petrosal artery from the middle meningeal. It passes by the hiatus Fallopii. Tympanic from the internal carotid artery, while in the carotid canal. Auditory from the basilar, which enters the internal auditory meatus and is distributed to the cochlea and vestibule.

LESSON CLXXV.

ORIGIN AND INSERTION OF THE MUSCLES ATTACHED TO TEMPORAL BONE.

1. **Temporal muscle** which has been described on page 508.

2. **Masseter muscle.**—**DESCRIPTION.**—There is a strong layer of fascia which is derived from the deep cervical fascia which covers this muscle and is connected with it. This fascia is attached to the lower border of the zygoma, and posteriorly it covers the parotid gland, making the parotid fascia. The Masseter muscle consists of two portions, a superficial and a deep portion. The deep portion is smaller and more muscular than the superficial portion. These two portions are united at their insertion. The parotid gland overlaps its posterior margin, while its anterior margin overlaps the Buccinator muscle. The facial vein crosses its lower anterior angle.

ORIGIN.—The origin of the superficial portion is from the malar process of the superior maxillary bone, and the anterior two-thirds of the lower border of the zygomatic arch. The origin of the deep portion is from the posterior

one-third of the lower border of the zygomatic arch and all of its inner surface.

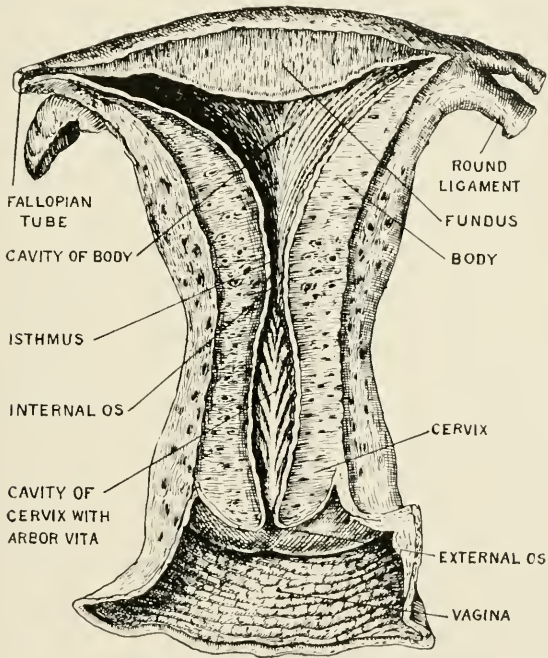
INSERTION.—The insertion of the superficial portion is into the angle and lower half of the outer surface of ramus of the jaw. The insertion of the deep portion is in the upper half of the ramus and outer surface of the coronoid process of the lower jaw.

ACTION.—It is a muscle of mastication. It raises the back part of the lower jaw.

NERVE SUPPLY.—Masseteric branch of inferior maxillary division of the fifth nerve.

BLOOD SUPPLY.—Facial artery, transverse facial artery, and the masseteric branch of the inferior maxillary artery.

PLATE CCLXXI.



THE UTERUS, HORIZONTAL SECTION.

3. **Occipito-frontalis muscle**, which has been described on page 513.

4. **Sterno-cleido-mastoid**, which has been described on page 40.

5. **Splenius capitis**, which has been described on page 272.

6. **Trachelo-mastoid**, which has been described on page 274.

7. **Digastric.**—**DESCRIPTION.**—This muscle, which pierces the Stylo-hyoid muscle near its insertion on the hyoid bone, consists of two fleshy bellies and a rounded tendon between them. From this tendon of the Digastric a broad aponeurosis is given off which is attached to the body and greater cornu of the hyoid bone. This aponeurosis is called the supra-hyoid aponeurosis.

ORIGIN.—The origin of the posterior belly is from the digastric groove of the mastoid process of the temporal bone. The origin of the anterior belly is from the fossa on the inner surface of the inferior maxillary bone near the symphysis.

INSERTION.—Into its central tendon, which is held to the body of the hyoid bone by the supra-hyoid aponeurosis.

ACTION.—To raise the hyoid bone and tongue, to depress the lower jaw and assist in opening the mouth.

NERVE SUPPLY.—The posterior belly receives the facial nerve, while the anterior belly receives the mylo-hyoid branch of the inferior dental nerve.

BLOOD SUPPLY.—Facial artery, occipital artery, and posterior auricular artery.

8. *Retrahens aurem*.—

ORIGIN.—From the mastoid process of the temporal bone.

INSERTION.—Into concha of ear, and lower part of cranial surface.

ACTION.—To retract the pinna.

NERVE SUPPLY.—Posterior auricular branch of the facial nerve.

BLOOD SUPPLY.—Branches from posterior auricular.

9. **Stylo-pharyngeus.**—**DESCRIPTION.**—This muscle, which extends from the styloid process of the temporal bone to the pharynx, is a long slender muscle, rounded above and broad and thin below. The stylo-pharyngeus nerve in passing to the tongue lies on the outer side of this muscle.

ORIGIN.—From the inner side and base of styloid process.

INSERTION.—Into the Constrictor muscles, Palato-pharyngeus muscle, and the posterior border of the thyroid cartilage.

ACTION.—To elevate and widen the pharynx.

NERVE SUPPLY.—Glosso-pharyngeal.

BLOOD SUPPLY.—Is same as the blood supply to the pharynx, which is found on page 315.

10. **Stylo-hyoid.**—**DESCRIPTION.**—This muscle is perforated near its insertion by the tendon of the Digastric muscle. It is situated in front of and above the posterior belly of the Digastric.

ORIGIN.—From the styloid process of the temporal bone near its base.

INSERTION.—Into the body of the hyoid bone.

ACTION.—It elevates and retracts the hyoid bone.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Same as Digastric muscle.

11. **Stylo-glossus.**—**DESCRIPTION.**—This is the shortest and smallest of the Styloid muscles.

ORIGIN.—From the anterior and external surface of the styloid process near its apex, and from the stylo-hyoid ligament by a thin aponeurosis.

INSERTION.—Into the sides of the tongue, and entering the dorsum of the tongue blends with the Lingualis muscle in front of the Hyo-glossus muscle, and its oblique portion passes over the Hyo-glossus muscle and decussates with its fibers.

ACTION.—To elevate and retract the tongue.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Facial, lingual and ascending pharyngeal.

12. Levator palati.—**DESCRIPTION.**—This muscle, which is long, thick, and rounded, is situated on the outer side of the posterior nares.

ORIGIN.—From the under surface of the apex of the petrous portion of the temporal bone, and from the inner surface of the cartilaginous portion of the Eustachian tube.

INSERTION.—Into the posterior surface of the soft palate where it blends with the muscle of the opposite side.

ACTION.—It elevates the soft palate.

NERVE SUPPLY.—The spinal accessory through the pharyngeal plexus possibly from the facial through the petrosal branch of the vidian nerve.

BLOOD SUPPLY.—Ascending palatine, ascending pharyngeal, descending palatine, lingual.

13. Tensor tympani.—**DESCRIPTION.**—This muscle is situated above the osseous portion of the Eustachian tube in a bony canal. It is separated from the Eustachian tube by the processus cochleariformis.

ORIGIN.—From the canal it is situated in, under surface of the petrous portion of the temporal bone, and the cartilaginous portion of the Eustachian tube.

INSERTION.—Into the handle of the malleus near its root.

ACTION.—To tense the tympanic membrane.

NERVE SUPPLY.—From the otic ganglion of the fifth nerve.

BLOOD SUPPLY.—Tympanic branch of ascending pharyngeal.

14. Stapedius.—**DESCRIPTION.**—This is the smallest muscle in the body.

ORIGIN.—From the sides of the cavity in the tympanum. Its tendon passes through the foramen in the apex of the pyramid.

INSERTION.—Into the neck of the stapes.

ACTION.—To draw the head of the stapes backward and thus rotating its base inward towards the vestibule, and probably compressing the contents of the vestibule.

NERVE SUPPLY.—Tympanic branch from the seventh.

BLOOD SUPPLY.—Tympanic branch of internal maxillary.

15. Tensor palati.—**DESCRIPTION.**—This is a broad triangular muscle with its base upward, and lies at the outer side of the Levator palati.

ORIGIN.—From scaphoid fossa at the base of the internal pterygoid plate, spine of sphenoid bone, vaginal process of temporal bone, cartilaginous portion of the Eustachian tube, and hamular process.

INSERTION.—Into the anterior surface of the soft palate, and the transverse ridge on the horizontal portion of the palate bone.

ACTION.—It tenses the soft palate, and opens Eustachian tube during deglutition.

NERVE SUPPLY.—Otic ganglion of the fifth nerve.

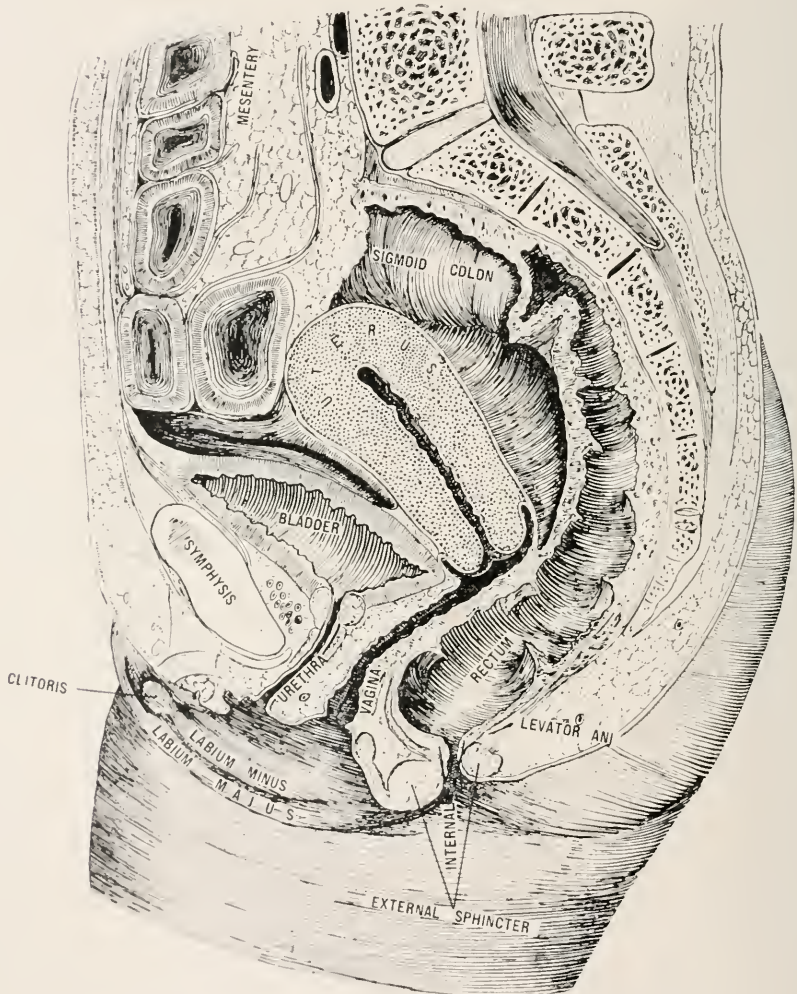
BLOOD SUPPLY.—Ascending palatine, ascending pharyngeal, descending palatine, lingual.

LESSON CLXXVI.

ETHMOID BONE. (Plates CCLVIII-CCLIX.)

The **ethmoid bone** which consists of a horizontal plate, a perpendicular plate and two lateral masses is situated at the base of the cranium between the orbits. It is a light spongy bone and cubical in form. ITS BODY HAS THE FOLLOWING POINTS FOR CONSIDERATION:

PLATE CCLXXII.



A SAGITTAL SECTION OF THE FEMALE ORGANS OF GENERATION.

1. **CRIBRIFORM PLATE** (horizontal) forms part of the anterior fossa of the skull as it is situated in the ethmoidal notch of the frontal bone and between its orbital plates.

2. **CRISTA GALLI** is situated in the median line of the cribiform plate anteriorly. It is thick and triangular. The long border of this triangle, which is the posterior one, gives attachment to the falx cerebri. The anterior border of this triangle, by its articulation with the frontal bone completes the foramen cæcum. Between the two laminae of this triangle, there may be a sinus.

3. **GROOVES** are on this plate on each side of the crista galli for the olfactory bulbs.

4. **FORAMINA** perforate this horizontal plate for the passage of the olfactory nerves. These foramina are in three rows, (a) an inner row, which leads to the nasal septum, (b) a middle row which leads to the roof of the nose, and (c) an outer row which leads to the superior turbinated bone.

5. **NASAL SLIT** is on the side of the crista galli anteriorly and is for the passage of the nasal nerve, which is a branch of the fifth nerve.

6. **TRIANGULAR NOTCH** is at the back of the cribiform plate for the ethmoid spine of the sphenoid.

7. **THE PERPENDICULAR PLATE** descends from the under surface of the cribiform plate and assists to form the nasal septum. Its sides are grooved for filaments of the olfactory nerves. The nasal spine of the frontal and crests of the nasal bones articulate with its anterior border. The ethmoidal crest of sphenoid articulates with the upper half of its posterior border, while the vomer articulates with the lower half of this border. The triangular cartilage is attached to its inferior border.

THE LATERAL MASSES OF THE ETHMOID BONE CONSIST OF A NUMBER OF CELLULAR CAVITIES, AND EACH LATERAL HALF PRESENTS THE FOLLOWING POINTS FOR CONSIDERATION:

1. **THE ETHMOIDAL CELLS** have thin walls and are situated between two plates which form its sides.

2. **OS PLANUM OR ORBITAL PLATE** forms the outer surface of these cells and also forms the inner wall of the orbit. It articulates with the orbital plate of the frontal bone above, and forms the anterior and posterior ethmoidal foramina by their notched borders coming together with the superior maxillary bone below, with the lachrymal bone in front, and with the sphenoid and orbital process of the palate bone behind.

3. **THE MIDDLE TURBINATED PROCESS**, which is concave outward and forms part of the middle meatus, is the end of a thin plate of bone which descends from the cribiform plate, and forms part of the outer wall of the nasal fossa.

4. **THE SUPERIOR TURBINATED PROCESS** curves downward and outward.

5. **THE UNCIFORM PROCESS** passes downward to articulate with the inferior turbinated bone and forms part of the inner wall of the antrum of Highmore.

OSSIFICATION.—It ossifies from three centers. One center for the body and one for each lateral mass.

ARTICULATION.—It articulates with thirteen bones, namely, the sphenoid and frontal of the cranium, and all the bones of the face except the two malar and the inferior maxillary. The bones of the face it articulates with are: the two nasal, two superior maxillary, two lachrymal, two palate, two inferior tur-

binated, and the vomer. The ethmoid bone with its articulations form the nasal fossa. The two sphenoidal turbinated bones articulate with the ethmoid also, but as they are processes of the sphenoid we do not name them in the articulations of the ethmoid, since the sphenoid itself has been named.

ATTACHMENT OF MUSCLES.—There are no muscles attached to this bone.

BLOOD SUPPLY.—Anterior ethmoidal artery, posterior ethmoidal artery, and nasal or sphenopalatine branch of internal maxillary artery.

LESSON CLXXVII.

SPHENOID BONE. (Plates CCXLIII-CCXLIV).

The **sphenoid bone** forms most of the middle fossa at the base of the skull. It touches all the bones of the cranium, the vomer, two palate and two malar of the face. Occasionally its external pterygoid plate articulates with the superior maxillary bone. It presents the following points for consideration:

1. A **body**, which is a hollow cuboid structure with six surfaces.

The **superior surface** has in front THE ETHMOIDAL SPINE which articulates with the cribriform plate of the ethmoid. It then has a SMOOTH SURFACE with a slight longitudinal eminence in the mid-line and on each side of this eminence is a groove for the olfactory tract. The next point is THE OPTIC GROOVE, which lodges the optic commissure and ends on each side in THE OPTIC FORAMEN which is for the passage of the optic nerve and the ophthalmic artery. THE OLIVARY PROCESS is immediately behind the optic groove. THE SELLA TURCICA (pituitary fossa), which is for the pituitary body (hypophysis) of the brain, is just behind the olivary process. THE MIDDLE CLINOID PROCESSES bound the sella Turcica in front. THE DORSUM SELLE (dorsum ephippii) bounds the sella Turcica behind, and is grooved on each side for the sixth nerve. THE POSTERIOR CLINOID PROCESSES are at each upper angle of the dorsum sellæ. GROOVES are situated laterally on the body for the cavernous sinus and the internal carotid artery. They are curved like the Italic letter f. THE LINGULA is a ridge along the outer margin of this groove posteriorly. THE CLIVUS is a shallow depression which lodges the pons and slopes backward from the dorsum sellæ to be continuous with the basilar groove of the occipital bone.

The **posterior surface** joins the basilar process of the occipital bone. This surface is quadrilateral in shape and there is a layer of cartilage between it and the occipital bone until about the twentieth year.

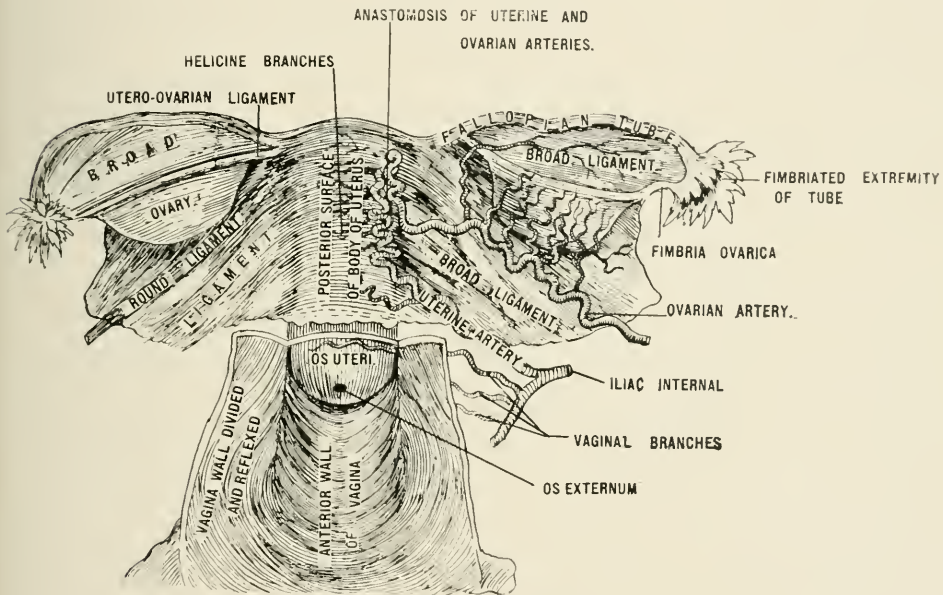
The **anterior surface** has in the median line THE ETHMOIDAL CREST. This crest articulates with the perpendicular plate of the ethmoid. SPHENOIDAL CELLS or SINUSES are on each side of this ethmoidal crest. THE SPHENOIDAL TURBINATED BONE partly closes these cells or sinuses in front and below, but they communicate with the nose and sometimes with the posterior ethmoidal cells. This surface articulates with the orbital process of the frontal bone ABOVE, and with the orbital process of the palate bone BELOW, and with the os planum of the ethmoid laterally.

The **inferior surface** has in its mid-line THE ROSTRUM, which articulates with the upper edge of the vomer. THE VAGINAL PROCESSES are on each side, and articulate with the alæ of the vomer. This inferior surface helps to form

the nasal fossa. GROOVES, which articulate with the sphenoidal processes of the palate bone, form the pterygo-palatine canals which are for the transmission of the pterygo-palatine vessels and nerves.

2. The **greater wings** of the sphenoid arise from the sides of the body and curve upward, outward, and backward. Each great wing has the following points for consideration: (a) FORAMEN ROTUNDUM for the superior maxillary division of the fifth nerve, (b) FORAMEN OVALE for the inferior maxillary division of the fifth nerve, the small petrosal nerve, small meningeal artery, (c) FORAMEN VESALII transmits a small vein, this foramen is often absent, (d) FORAMEN SPINOSUM transmits the middle meningeal artery, veins, and sympathetic filaments from the cavernous plexus. This foramen is often double.

PLATE CCLXXIII.



THE UTERUS WITH VAGINA LAID OPEN.

The **external surface** of the greater wing is convex and is divided by the transverse pterygoid ridge into an upper portion, and a lower portion. The upper portion is larger and forms part of the temporal fossa, and the lower portion forms part of the zygomatic fossa. This lower surface ends posteriorly in the spinous process, or **spine**, of the sphenoid. This process gives attachment to the Tensor palati and internal lateral ligament of the lower jaw.

The **anterior or orbital surface** of the greater wing of the sphenoid forms part of the outer wall of the orbit, and is quadrilateral in shape. The upper border of this surface articulates with the frontal bone, the outer border with the malar bone, and the lower border, which is rounded, helps to form the pterygo-maxillary fissure, while the inner, which is sharp, forms the lower border of the sphenoidal fissure (anterior lacerated). This surface has a notch

at its upper part for a branch of the lachrymal artery, and a spine at its center which gives origin to one head of the External rectus muscle.

The **circumference** of the greater wing of the sphenoid articulates with the temporal and frontal bones. Part of its inner portion forms the lower boundary of the sphenoidal fissure and helps to form the foramen lacerum medium.

3. The **lesser wings** of the sphenoid bone (processes of Incerassias) project outward from the upper and lateral part of the body to end in a sharp point. Each wing has two roots; the upper is thin and flat, and the lower is thicker and has near the body a small tubercle to which is attached the ligament of Zimm. THE OPTIC FORAMEN which transmits the optic nerve and the ophthalmic artery is between these roots. The anterior border of each wing articulates with the frontal bone, while the posterior border lies in the fissure of Sylvius, and ends in THE ANTERIOR CLINOID PROCESS internally. Its upper surface is smooth and flat and is situated in the anterior fossa at the base of the skull. The lower surface forms the upper border of the sphenoidal fissure and the back of the roof of the orbit. THE SPHENOIDAL FISSURE (anterior lacerated) is bounded above by the lesser wing of the sphenoid, internally by the body of the sphenoid, and below by the inner margin of the orbital surface of the greater wing of the sphenoid. THE FOLLOWING STRUCTURES pass through the sphenoidal fissure: the third nerve, fourth nerve, three divisions of the ophthalmic division of the fifth the sixth nerve, filaments from the cavernous plexus of the sympathetic, orbital branches of the middle meningeal artery, the ophthalmic vein, and recurrent branch of the lachrymal artery.

4. The **pterygoid processes** of the sphenoid bone descend on either side from the junction of the body with the greater wing. Each process consists of two plates, external pterygoid plate and internal pterygoid plate, and a pterygoid fossa. THE EXTERNAL PTERYGOID PLATE forms part of the inner wall of the zygomatic fossa and gives attachment to the External pterygoid muscle, and its inner surface gives attachment to the Internal pterygoid muscle. THE INTERNAL PTERYGOID PLATE is longer and narrower than the external one and has on its extremity the hamular process around which the tendon of the Tensor palati muscle turns. THE SCAPHOID FOSSA is at the base of the internal pterygoid plate and gives origin to the Tensor palati muscle. THE VIDIAN CANAL is at the root of the pterygoid process for the vidian nerve and vessels. A TRIANGULAR NOTCH is at the root of the hamular process to articulate with the pterygoid process of the palate bone.

5. The **sphenoidal turbinated bones** (spongy) articulate in front with the ethmoid and with the palate externally. They are irregular bones, wide anteriorly, and tapering posteriorly.

OSSIFICATION.—This bone ossifies from fourteen centers.

ARTICULATION.—It articulates with twelve bones which are, the two malar, the two palate, and the vomer of the face, and with all the bones of the cranium which are, frontal, ethmoid, two parietal, two temporal, and the occipital.

ATTACHMENT OF MUSCLES.—It has twelve pairs of muscles attached to it. The Temporal of the temporo-maxillary region, the External pterygoid and the

Internal pterygoid of the pterygo-maxillary region, the Superior constrictor of the pharynx, the Tensor palati of the soft palate, the Levator palpebræ of the orbital region, the Superior oblique of the orbital region, the Superior rectus, Inferior rectus, External rectus, and Internal rectus of the orbital region, and the Laxator tympani.

BLOOD SUPPLY.—Middle and small meningeal, anterior deep temporal, vidian, pterygo-palatine and sphenopalatine, and twigs from the internal carotid.

LESSON CLXXVIII.

1. **Temporal** muscle which has been described on page 508.

2. **External pterygoid.**—**DESCRIPTION.**—This muscle, which passes almost horizontally between the zygomatic fossa and the condyle of the jaw, is a thick, short muscle, conical in form.

ORIGIN.—It arises by two heads between which pass the buccal nerve and the internal maxillary artery. The upper head comes from the pterygoid arch and the inferior surface of the greater wing of the sphenoid, while the lower head comes from the outer surface of the external pterygoid plate, and from the tuberosities of the palate and superior maxillary bone.

INSERTION.—Into a depression in front of the condyle of the lower jaw, and the inter-articular fibro-cartilage.

ACTION.—To draw the condyle and interarticular fibro-cartilage forward and inward.

NERVE SUPPLY.—Pterygoid branch of the inferior maxillary division of the fifth.

BLOOD SUPPLY.—External pterygoid branches of the internal maxillary artery.

3. **Internal pterygoid.**—**DESCRIPTION.**—This muscle is a thick and quadrilateral.

ORIGIN.—From the inner surface of the external pterygoid plate and from the tuberosity of the palate bone, and the adjacent part of the superior maxillary.

INSERTION.—Into the internal surface of the ramus of the jaw as high as the mandibular foramen and mylo-hyoid groove.

ACTION.—To close the mouth and to draw the lower jaw forward and inward.

NERVE SUPPLY.—Inferior maxillary division of the fifth nerve.

BLOOD SUPPLY.—Branches from the second division of the internal maxillary artery.

4. **Superior constrictor** muscle which has been described on page

5. **Tensor palati** muscle which has been described on page

6. **Levator palpebræ** (superioris).—**DESCRIPTION.**—This muscle is triangular in shape and is narrow and tendinous at its origin, but broad and fleshy in its center and ends in a wide aponeurosis which passes between the fibers of the Orbicularis to its insertion.

ORIGIN.—From the under surface of the lesser wing of the sphenoid bone above and in front of the optic foramen.

INSERTION.—Into the aponeurosis of the upper tarsal cartilage, skin of lid, and conjunctiva.

ACTION.—Lifts the upper lid and antagonizes the Orbicularis palpebrarum.

NERVE SUPPLY.—A branch of the third nerve which pierces the superior rectus muscle.

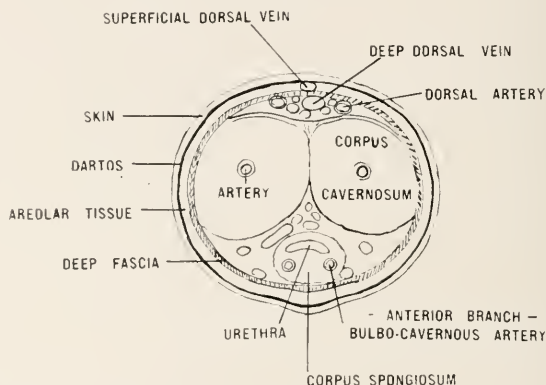
BLOOD SUPPLY.—Muscular branches from the ophthalmic artery.

7. Superior oblique.—**DESCRIPTION.**—This muscle belongs to the orbital region and receives the fourth nerve.

ORIGIN.—From above the inner margin of optic foramen. Its tendon passes through a pulley near the internal angular process of the frontal bone, then beneath the Superior rectus muscle.

INSERTION.—Into the sclerotic coat between the Superior rectus and External rectus muscle at right angles to these muscles.

PLATE CCLXXIV.



A TRANSVERSE SECTION OF THE PENIS.

ACTION.—It rotates the eye-ball on its antero-posterior axis, drawing the cornea downward and outward.

NERVE SUPPLY.—Fourth cranial nerve.

BLOOD SUPPLY.—Muscular branches from the ophthalmic artery.

8. Superior rectus.—**DESCRIPTION.**—This is the thinnest and narrowest of the Recti muscles.

ORIGIN.—From the upper margin of the optic foramen, and fibrous sheath of the optic nerve.

INSERTION.—Into the sclerotic coat three or four lines from the sclero-corneal junction.

ACTION.—Elevates and abducts and rotates the cornea inward.

NERVE SUPPLY.—Third cranial nerve.

BLOOD SUPPLY.—Muscular branches of the ophthalmic artery.

9. Inferior rectus.—

ORIGIN.—From the ligament of Zinn with the Internal rectus.

INSERTION.—Into the sclerotic coat three of four lines from the sclero-corneal junction.

ACTION.—Abducts the cornea.

NERVE SUPPLY.—Third nerve.

BLOOD SUPPLY.—Muscular branches of the ophthalmic artery.

10. External rectus.—**DESCRIPTION.**—This is the largest of the Recti muscles.

ORIGIN.—From two heads. The outer head from the outer margin of the optic foramen. The lower head from the ligament of Zinn and the lower margin of the sphenoidal fissure.

INSERTION.—Into the sclerotic coat.

ACTION.—It abducts the cornea.

NERVE SUPPLY.—The sixth nerve.

BLOOD SUPPLY.—Muscular branches from the ophthalmic artery.

All the structures on the floor of the sphenoidal fissure are between the two heads of the External rectus muscle, namely, ophthalmic vein, sixth, two divisions of the third, and the nasal branch of the fifth nerves.

11. Internal rectus.—**DESCRIPTION.**—This is the broadest of the meet muscles.

ORIGIN.—From the ligament of Zinn.

INSERTION.—Into the sclerotic coat.

ACTION.—It adducts the cornea.

NERVE SUPPLY.—From the inferior division of the third cranial nerve.

BLOOD SUPPLY.—Muscular branches of the ophthalmic artery.

12. Laxator tympani, so-called by Sommering, is now called the anterior ligament of the malleus. It is attached to the neck of the malleus and to the anterior wall of the tympanum, with some of its fibers passing through Glas-erian fissure to the spine of the sphenoid bone.

LESSON CLXXIX.

NASAL BONE. (Plate CCL).

The **nasal bone**, which with its fellow forms the bridge of the nose, is a bone with two surfaces and four borders. It is situated at the upper part of the face.

The **outer surface** is convex transversely, but concave from above downward. It has many small furrows for arteries, and at its center a foramen for a vein. This foramen may be double.

The **inner surface** is just the reverse of the outer surface, which makes it concave transversely and convex from above downward. There is a longitudinal groove on this surface for a branch of the nasal nerve.

The **superior border** articulates with the nasal notch of the frontal bone. It is serrated, thick, and narrow.

The **inferior border** is thinner and broader than the superior border, and gives attachment to the lateral cartilage. There is a notch at its middle for the branch of the nasal nerve.

The **external border** articulates with the nasal process of the superior maxillary bone.

The **internal border** articulates with its fellow, and with the nasal spine of the frontal bone above and the perpendicular plate of the ethmoid below.

OSSIFICATION.—It ossifies from one center.

ARTICULATION.—It articulates with four bones. The frontal and ethmoid of the cranium, and its fellow and the superior maxillary of the face.

ATTACHMENT OF MUSCLES.—A few fibers of the Occipito-frontalis of the cranial region may be attached to this bone.

BLOOD SUPPLY.—Nasal branch of the ophthalmic artery, frontal, the angular and the anterior ethmoidal arteries.

For **ORIGIN** and **INSERTION** of the **Occipito-frontalis** muscle see page

LACHRYMAL BONE. (Plate CCLI.)

The **lachrymal bone** lies on the anterior part of the inner wall of the orbit. It resembles a finger nail, and has the following points for consideration:

The **external surface** has upon it a vertical ridge called the lachrymal crest which passes in its mid-line and ends below in the hamular process. This process is sometimes separated from the bone and then is called the lesser lachrymal bone. It helps to form the lachrymal groove above by articulating with the lachrymal tubercle of the superior maxillary bone. The portion of this surface behind the lachrymal crest helps to form the inner wall of the orbit, while the part in front of the lachrymal crest forms part of the lachrymal groove.

The **internal surface**, or **nasal surface**, forms part of the middle meatus by its anterior portion, while its posterior portion by its articulation with the ethmoid bone completes the anterior ethmoidal canals. This surface has a furrow upon it corresponding to the position of the crest of the external surface.

The **anterior border** articulates with the nasal process of the superior maxillary bone and is the longest.

The **posterior border** articulates with the os planum of the ethmoid.

The **superior border**, which is the shortest and thickest, articulates with the internal angular process of the frontal bone.

The **inferior border** articulates with the lachrymal process of the inferior turbinated bone, and posteriorly with the orbital plate of the superior maxillary bone. These two portions of this border are separated by the crest.

OSSIFICATION.—It ossifies from one center.

ARTICULATION.—It articulates with four bones. The frontal and ethmoid of the cranium, and the superior maxillary and inferior turbinated of the face.

ATTACHMENT OF MUSCLES.—It has one muscle attached to it, namely, the Tensor tarsi of the palpebral region.

BLOOD SUPPLY.—Inferior orbital, nasal branch of ophthalmic, and anterior ethmoidal arteries.

Tensor tarsi.—**DESCRIPTION.**—This muscle is the deep part of the Orbicularis palpebrarum.

ORIGIN.—It arises from the crest of the lachrymal bone and passes across the lachrymal sac and divides into two portions.

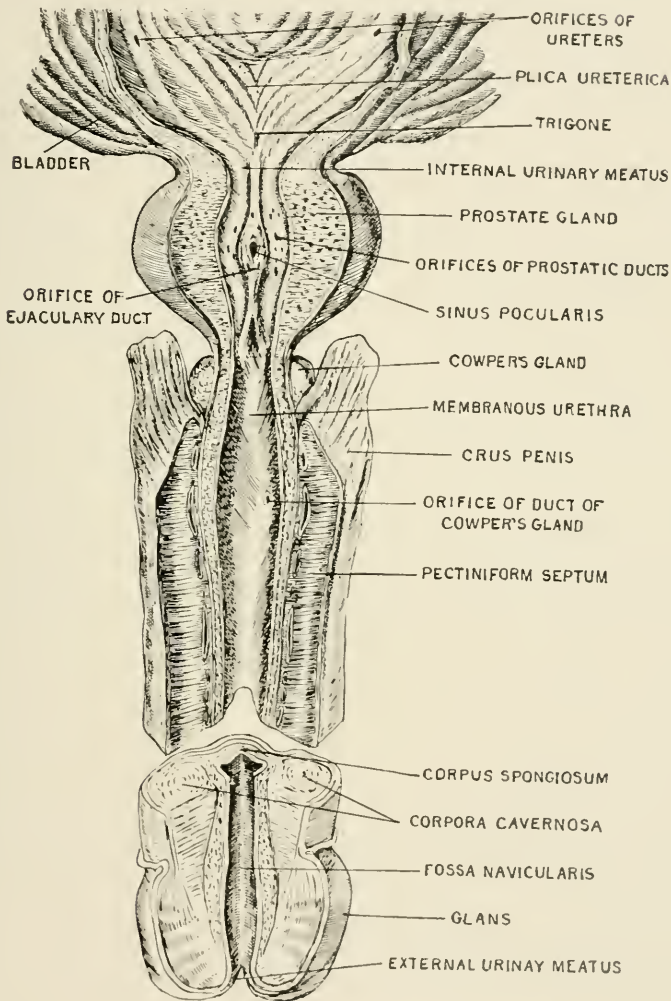
INSERTION.—Into the upper and lower tarsal cartilages.

ACTION.—To compress the puncta lachrymalia against the globe of the eye, and to compress the lachrymal sac into a position most favorable for receiving the tears.

NERVE SUPPLY.—Facial, and perhaps the third nerve.

BLOOD SUPPLY.—Branches from the facial artery.

PLATE CCLXXV.



A HORIZONTAL SECTION OF THE PENIS.

LESSON CLXXX.

MALAR BONE. (Plates CCLIV-CCLV.)

The **malar bone**, or cheek bone, is situated at the outer and upper parts of the face. It forms part of the outer wall and the floor of the orbit, and part of the temporal and zygomatic fossae.

The **external surface** of the malar bone is convex and gives attachment to the Zygomaticus major and the Zygomaticus minor. It has a malar foramen for malar branch of temporo-malar nerve and vessels.

Its **inner surface** is concave and has a triangular rough surface for its articulation with the superior maxillary. It has a smooth concave surface externally which forms part of the temporal fossa above and part of the zygomatic fossa below. This surface gives origin to the Masseter muscle.

The **orbital border**, or antero-superior, forms part of the circumference of the orbit.

The **maxillary border**, or antero-inferior, articulates with the superior maxillary bone. The Levator labii superioris proprius muscle is attached to this border.

The **temporal border**, or postero-superior, is a curved border. The temporal fascia is attached to this border which is continuous with the temporal ridge above and with the upper border of the zygomatic arch below.

The **zygomatic border**, or postero-inferior, is continuous with the lower border of the zygomatic arch and gives origin to the Masseter muscle.

The **maxillary process** articulates with the superior maxillary bone. It is rough and triangular.

The **zygomatic process** articulates with the zygomatic process of the temporal bone.

The **frontal process** articulates with the external angular process of the frontal bone.

The **orbital process** passes backward forming part of the floor and outer wall of the orbit. It also forms part of the temporal fossa and bounds the spheno-maxillary fissure anteriorly. It presents the inner opening of the temporo-malar canals.

OSSIFICATION.—From two or three centers.

ARTICULATION.—It articulates with four bones. The frontal, sphenoid, and temporal of the cranium, and the superior maxillary of the face.

ATTACHMENT OF MUSCLES.—It has five muscles attached to it. Levator labii superioris proprius of the superior maxillary region, Zygomatic major and Zygomatic minor of the superior maxillary region, the Masseter of the temporo-maxillary region, Temporal of the temporo-maxillary region.

BLOOD SUPPLY.—Inferior orbital, lachrymal branches of the ophthalmic, transverse facial, and deep temporal arteries.

Levator labii superioris proprius.—

ORIGIN.—From the superior maxillary bone above the infraorbital foramen, also from the lower border of the maxillary process of the malar bone.

INSERTION.—Into the facial part of the Orbicularis oris.

ACTION.—To elevate and protrude the lip.

NERVE SUPPLY.—Facial nerve.

BLOOD SUPPLY.—Branches from the facial artery.

The infraorbital plexus, which is formed by the fifth and seventh nerves and the anastomosis of the infraorbital and facial arteries, are beneath this muscle.

Zygomaticus major.—

ORIGIN.—From the malar bone on its posterior aspect of external border.

INSERTION.—Into the angle of the mouth.

ACTION.—It raises the lip outward.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Branches from the facial artery.

Zygomaticus minor.—Stenson's duct the facial artery and vein pass under this muscle.

ORIGIN.—From the anterior aspect of the external surface of the malar bone.

INSERTION.—Into the angle of the mouth, where it blends with the Levator labii superioris.

ACTION.—To raise the lip outward.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Branches from the facial artery.

Masseter muscle which has been given on page 520.

Temporal muscle which has been given on page 508.

LESSON CLXXXI.

SUPERIOR MAXILLARY BONE. (Plates CCLII-CCLIII).

The **superior maxillary bones** are two in number and form the upper jaw. There is only one bone of the face larger than the superior maxillary and that is the inferior maxillary. This bone forms parts of the roof of the mouth, of the floor and outer wall of the nose, of the floor of the orbit; and parts of the zygomatic and speno-maxillary fossæ, speno- and pterygo-maxillary fissures.

The **body** of the superior maxillary bone is a hollow cube. This hollow is called the antrum of Highmore.

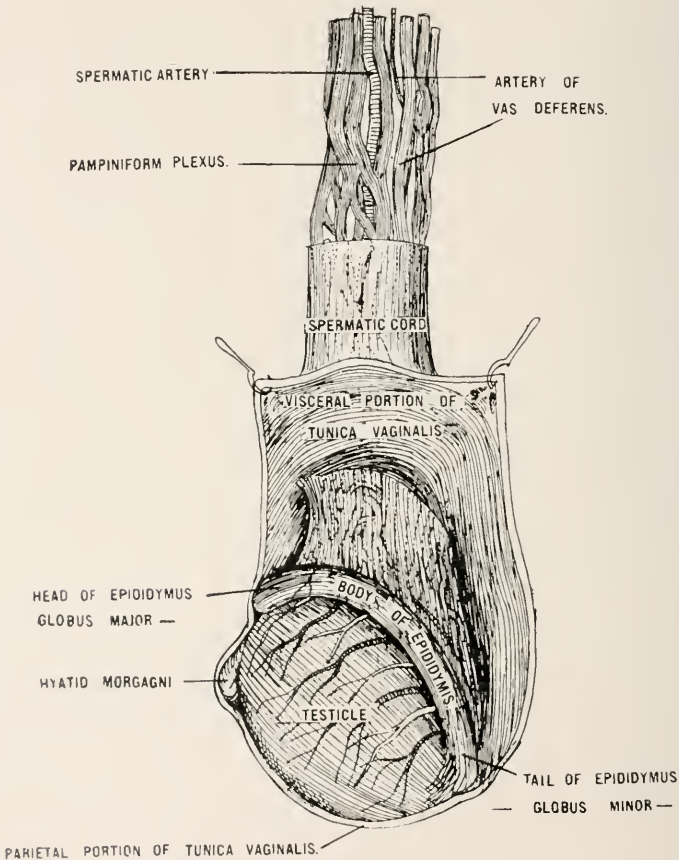
The **external surface**, or facial surface of the body, looks forward and outward. On this surface we have the following points for consideration: The incisive fossa is just above the incisor teeth and gives origin for the Depressor alæ nasi muscle. Just below this fossa a portion of the Orbicularis oris is attached to the alveolar border. External to this fossa is the origin of the Compressor alæ nasi. The canine fossa, which gives origin to the Levator anguli oris, is separated from the incisive fossa by the canine eminence. This eminence is a vertical ridge produced by the canine tooth. The infraorbital foramen, which is for the infraorbital vessels and nerve, is above the canine fossa. The margin of the orbit gives attachment to the Levator labii superioris propus muscle.

The **posterior**, or zygomatic surface is convex and forms part of the zygomatic fossa. On this surface we have the following points for consideration: Near its center are the openings of the posterior dental canals for the posterior dental vessels and nerve. The tuberosity, which is at the lower part of this surface, gives origin to the Internal pterygoid muscle. This tuberosity articulates with the tuberosity of the palate bone and some times with the external pterygoid plate of the sphenoid. A groove just above this tuberosity is con-

verted into the posterior dental canal by its articulation with the palate bone.

The **superior surface**, or orbital surface, forms part of the floor of the orbit. Its inner border articulates with the orbital process of the palate bone behind, and with the os planum of the ethmoid in the middle, and with the lachrymal bone in front. Its outer border helps to form the sphenomaxillary fissure and sometimes articulates with the orbital plate of the sphenoid bone. Its anterior border helps to form the circumference of the orbit and is continuous

PLATE CCLXXVI.



TESTICLE AND SPERMATIC CORD.

with the nasal process internally and the malar process externally. The infraorbital groove, which is for the infraorbital vessels and nerve, runs forward in the mid-line to end in the infraorbital canal and foramen. This canal also opens into a small canal which runs in the anterior wall of the antrum for the passage of the anterior dental vessels and nerve. There may also be a second dental canal for the middle dental nerve which passes to the bicuspid teeth. The Inferior oblique muscle of the orbital region arises from a depression just external to the lachrymal groove.

The **internal surface** is divided into two parts by the palate process. The part above the palate process forms part of the outer wall of the nasal fossa and has the large opening of the antrum of Highmore. The part below the palate process forms part of the roof of the mouth and is concave. Above the opening of the antrum of Highmore are half cells which are completed by articulation with the ethmoid and lachrymal bones, while below the opening of the antrum of Highmore is a smooth surface which forms part of the inferior meatus. Behind this opening is a rough surface which articulates with the perpendicular plate of the ethmoid. This surface is crossed obliquely by a groove which is converted into the posterior palatine canal by its articulations with the palate bone. The lachrymal groove is in front of the antrum of Highmore and lodges the lachrymal duct. It is converted into a canal by its articulation with the lachrymal and inferior turbinated bones. The inferior turbinated crest, which articulates with the inferior turbinated bone, is anterior to the lachrymal groove. The middle meatus is the concavity above this crest, while the part below it is the inferior meatus.

The **antrum of Highmore** (maxillary sinus) (Plate CCLXIV) is a pyramidal cavity in the body of the superior maxillary bone. The apex of this cavity is formed by the malar process and its walls are the orbital, facial, and zygomatic surfaces of the body of the sphenoid bone. The outer wall of the nose forms its base in which there is the opening. This opening is partly closed by the ethmoid bone above, by the inferior turbinated below, by the palate bone behind. The posterior dental canals, which are for the posterior dental vessels and nerve, are on the posterior wall of this antrum. Processes on the floor of the antrum are produced by first and second molar teeth.

The **malar process**, which is triangular and rough, is situated between the facial surface and the zygomatic surface and articulates with the malar bone. This process gives partial origin to the Masseter muscle.

The **nasal process**, which passes upward, inward and backward by the side of the nose is triangular and thick. The Levator labii superioris alaeque nasi, Orbicularis palpebrarum, and Tendo oculiare attached to its external surface. Its internal surface makes part of the outer wall of the nose. The upper part of this surface articulates with the ethmoid bone completing the anterior ethmoidal cells, while below this is the superior turbinated crest which articulates with the middle turbinated bone. The middle meatus is immediately below, and below the middle meatus is the inferior turbinated crest.

The **upper border** of the nasal process articulates with the frontal bone.

The **anterior border** of this process articulates with the nasal bone.

The **posterior border** of this process has the lachrymal groove for the nasal duct, and the inner margin of this groove articulates with the lachrymal bone, while the outer margin of this groove forms part of the circumference of the orbit. Where it joins with the orbital surface is the lachrymal tubercle.

The **lachrymal groove** is made into a canal by the lachrymal bone and the lachrymal process of the inferior turbinated bone. This canal which opens into the inferior meatus, runs downward, outward, and backward. (Plate CCLII.)

Alveolar process has eight cavities in it for the teeth. This process is broadest behind and is the most spongy part of the superior maxillary bone. Its outer surface behind the first molar tooth gives origin to the Buccinator muscle.

The **palate process**, which passes inward from the inner surface of the body, forms part of the floor of the nasal cavity and the roof of the mouth. ON ITS INFERIOR SURFACE is a longitudinal groove or canal for the posterior palatine vessels and the anterior and external palatine nerves. It articulates with the vomer, the palate, and with its fellow process of the opposite side. At the point where the two palate processes meet anteriorly is THE ANTERIOR PALATINE CANAL OR FOSSA. There are four openings in the bottom of this fossa, the two lateral openings are called foramina of **Stenson**, and transmit anterior branches of the descending palatine arteries. The anterior and posterior foramina are called the foramina of **Scarpa**, and transmit the naso-palatine nerves. The left nerve passing through the anterior one and the right nerve through the posterior one. Sometimes a suture passes from this fossa on each side to the interval between the canine and incisor teeth, thus making a bone called the INTERMAXILLARY OR INCISIVE BONE. See plate CCXXVIII. THE SUPERIOR SURFACE is concave transversely and forms part of the floor of the nose, and has the upper openings of the canal of Scarpa and the canal of Stenson. The anterior part of the inner border of this surface is called THE NASAL CREST, which articulates with its fellow thus making a groove to receive the vomer. The anterior extremity of the nasal crest is THE ANTERIOR NASAL SPINE.

OSSIFICATION.—This bone ossifies from seven centers.

ARTICULATION.—It articulates with nine bones. The frontal and ethmoid of the cranium, and the nasal, malar, lachrymal, inferior turbinated, palate, and vomer of the face, and with its fellow of the opposite side. Sometimes it articulates with the external pterygoid plate of the sphenoid and also with the orbital plate of the sphenoid.

ATTACHMENT OF MUSCLES.—It has twelve muscles attached to it. The Orbicularis palpebrarum of the palpebral region, the Inferior oblique of the orbital region, Levator labii superioris alaeque nasi of the nasal region, Levator anguli oris of the superior maxillary region, the Compressor nasi, Depressor alae nasi, Dilator nares posterior of the nasal region, Masseter of the temporo-maxillary region, Buccinator of the inter-maxillary region, Internal pterygoid of the pterygo-maxillary region, Orbicularis oris of the intermaxillary region, Levator labii superioris propius of the superior maxillary region.

BLOOD SUPPLY.—Infraorbital, alveolar, descending palatine, ethmoidal, frontal, nasal, and facial arteries.

LESSON CLXXXII.

(1) **Orbicularis palpebrarum muscle** has been described on page 508.

(2) **Inferior oblique.**—

ORIGIN.—It arises from the orbital plate of the superior maxillary bone.

INSERTION.—Into the sclerotic coat below the insertion of the External rectus.

ACTION.—It turns the eye-ball on its antero-posterior axis outward and upward.

NERVE SUPPLY.—Third cranial.

BLOOD SUPPLY.—Muscular branches of the ophthalmic artery.

(3) **Levator labii superioris alæque nasi.**—

ORIGIN.—From the nasal process of the superior maxillary bone.

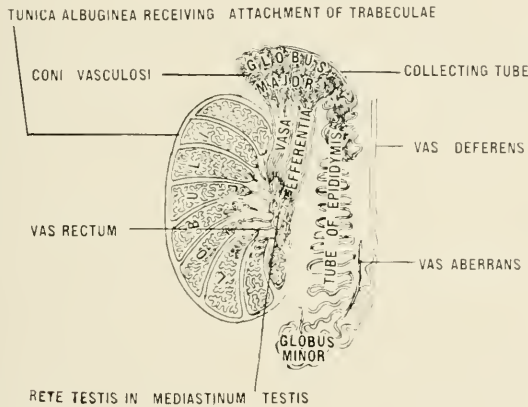
INSERTION.—Into the cartilage of the ala of the nose and into the facial part of the Orbicularis oris.

ACTION.—Elevates the upper lip and dilates the nostrils.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Angular artery from the facial.

PLATE CCLXXVII.



THE TESTICLE.

(4) **Levator anguli oris.**—

ORIGIN.—From the canine fossa of the superior maxillary bone.

INSERTION.—Into the facial part of the Orbicularis oris.

ACTION.—To lift the angle of the mouth.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Facial artery.

(5) Compressor nasi.—

ORIGIN.—From the superior maxillary bone above the incisive fossa.

INSERTION.—Into the fibro-cartilage of the nose, joining here its fellow of the opposite side and the *Pyramidalis nasi*.

ACTION.—It dilates the nostril.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Lateralis nasi of the facial artery.

(6) **Depressor alæ nasi.**—

ORIGIN.—From the incisive fossa of the superior maxillary bone.

INSERTION.—Into the septum and alar cartilage of the nose.

ACTION.—To contract the nostrils.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Branches of the facial.

(7) **Dilator nares posterior.**—

ORIGIN.—It arises from the margin of the nasal notch and sesamoid cartilages.

INSERTION.—Into the skin at the margin of the nostril.

ACTION.—To dilate the nostril.

NERVE SUPPLY.—Facial.

BLOOD SUPPLY.—Branches from the facial artery.

(8) **Masseter muscle** which has been described on page 520.

(9) **Buccinator.**—**DESCRIPTION.**—The upper and lower fibers of the Buccinator muscle meet at the angle of the mouth where they decussate to be continuous with the fibers of the Orbicularis oris, however, the highest and the lowest of these fibers do not decussate. This muscle, which is united with the Superior constrictor of the pharynx by the pterygo-maxillary ligament, forms a muscular wall for the mouth, while the Superior constrictor forms a muscular wall for the pharynx.

ORIGIN.—From the posterior alveolar processes of both the maxillary bones and the pterygo-maxillary ligament.

INSERTION.—Into the Orbicularis oris in a manner which has been described in the description of the muscle.

ACTION.—To compress the cheeks.

NERVE SUPPLY.—Facial, and buccal branch of the inferior maxillary division of the fifth nerve.

BLOOD SUPPLY.—Facial artery.

(10) **Internal pterygoid** which has been described on page 529.

(11) **Orbicularis oris.**—**DESCRIPTION.**—The fibers of this muscle are derived from the other facial muscles which are inserted into the lips, and it has fibers which belong to the lip itself. The fibers which belong to the lips pass in an oblique direction from the under surface of the skin through the thickness of the lip to the mucous membrane. Besides these two sets of fibers just mentioned, it has a third set of fibers which connect it with the superior maxillary bone and the septum of the nose.

ORIGIN.—By accessory fibers of nasal septum and the facial muscles surrounding the mouth.

INSERTION.—Into the Buccinator and other muscles surrounding the mouth. This muscle is not a sphincter muscle.

ACTION.—To pucker and close the mouth.

NERVE SUPPLY.—Buccal and supramaxillary divisions of the cervico-facial division of the seventh nerve.

BLOOD SUPPLY.—Superior and inferior coronary, and inferior labial.

(12) **Levator labii superioris proprius.**—**DESCRIPTION.**—This muscle covers the origin of the Compressor nasi and Levator anguli oris muscles, and the infraorbital vessels and nerve as they pass from the infraorbital foramen.

ORIGIN.—From the superior maxillary bone above the infraorbital foramen.

INSERTION.—Into the upper lip blending with the Orbicularis oris.

ACTION.—To elevate the lip.

NERVE SUPPLY.—Infraorbital branch of the facial.

BLOOD SUPPLY.—Facial.

LESSON CLXXXIII.

INFERIOR MAXILLARY BONE. (Plates CCLVI-CCLVII).

The **inferior maxillary bone** consists of a body shaped something like a horse shoe with the ends spread, and two vertical rami which meet the body at nearly a right angle. The body has the following points for consideration:

The **external surface of the body** is convex from side to side, but concave from above downward. The symphysis is a vertical ridge in the middle line marking the junction of the two lateral portions of the bone. The mental process is a prominent triangular eminence which forms the chin. The incisive fossa is situated on each side of the symphysis just below the incisor teeth, and gives origin to the Levator menti muscle. The Orbicularis oris has an origin just externally from this fossa. The mental foramen is just below the interval between the bicuspid teeth and is for the passage of the mental vessels and nerve. The external oblique line passes outward from the base of the mental process for a short distance, then passes upward and finally becomes continuous with the anterior border of the ramus. This line gives origin to the Depressor labii inferioris and the Depressor anguli oris muscles, while just below it is attached the Platysma myoides. There is a groove near the anterior inferior border of the Masseter muscle for the facial artery.

The **internal surface of the body** is concave from side to side and convex from above downward, just the reverse of the external surface. It has the following points for consideration:

A depression in the mid-line corresponding to the symphysis. The genial tubercles or mental spines are in two pairs and are situated just below the center of this depression on either side. The upper pair give attachment to the Genio-hyo-glossi, and the lower pair give attachment to the Genio-hyoidei. The sublingual fossa, which is for the sublingual gland, is external to these tubercles on either side. Beneath this sublingual fossa at the lower margin of the bone is the digastric fossa, which gives attachment to the Digastric muscle. The mylo-hyoid ridge passes obliquely upward and outward and gives attachment to the Mylo-hyoid muscle. The posterior extremity of this ridge gives attachment to the Superior constrictor muscle and the pterygo-maxillary ligament. The submaxillary fossa, which is for the submaxillary gland, is below the mylo-hyoid ridge. These oblique lines on the external surface and the internal surface divide the body into an upper and a lower portion.

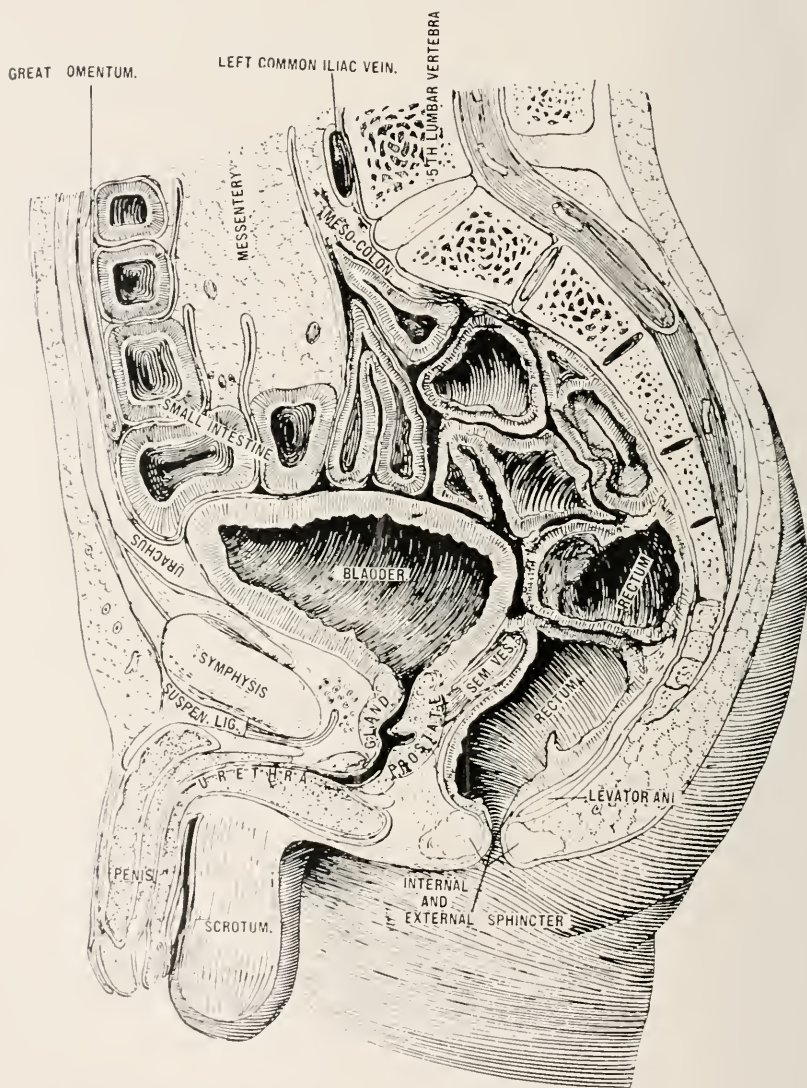
The **superior border of the body**, or alveolar border, is thick behind and has on each side eight cavities for the teeth. It gives attachment to the Buccinator muscle on its external surface behind the first molar tooth.

The **inferior border** is longer than the superior border and is thicker anteriorly which is just the reverse of the superior border. A groove for the

facial artery is on this border at the junction of the body with the ramus. This groove is also partly on the external surface.

The **rami of the inferior maxillary bone** are the perpendicular portions. They are quadrilateral in shape and each one has two surfaces, four borders,

PLATE CCLXXVIII.



A SAGITTAL SECTION OF THE MALE ORGANS OF GENERATION.

and two processes. The external surface of the ramus gives attachment to the Masseter muscle. The internal surface of the ramus has near its center the inferior dental foramen, which opens behind the spine. The mylo-hyoid groove runs obliquely downward from the dental foramen and lodges the mylo-

hyoid vessels and nerve. The Internal pterygoid muscle is attached to a rough surface behind this groove. The lingula is a sharp spine at the anterior margin of the mental foramen and gives attachment to the internal lateral ligament of the jaw.

THE ANTERIOR BORDER OF THE RAMUS is a continuation of the external oblique line.

THE SUPERIOR BORDER OF THE RAMUS has the coronoid process anteriorly, the deep sigmoid notch in the center, and the condyle of the lower jaw posteriorly. The deep sigmoid notch is crossed by the masseteric vessels and nerve.

THE POSTERIOR BORDER, which is thick and rounded, is saddled by the parotid gland.

THE INFERIOR BORDER is continuous with the body.

The **angle of the jaw** is the junction of the posterior border and the inferior border. On the lower part of the posterior border between the Masseter muscle externally and the Internal pterygoid muscle internally is the attachment of the stylo-maxillary ligament.

The **inferior dental canal**, which is for the inferior dental vessels and nerve, passes from the dental foramen in the ramus of the bone downward and forward. It now turns forward to pass under the alveoli in the body of the bone as far as the incisor teeth. It gives off a branch to the mental foramen. This canal lies near the internal surface of the bone for its first two-thirds, and near the external surface for its anterior one-third.

The **coronoid process**, which is at the anterior margin of the upper border of the ramus, is thin, flat, and triangular. It gives attachment to the Temporal muscle on both its external and internal surfaces.

The **condyloid process** is situated at the posterior margin of the superior border of the ramus. Its condyle, which has its long axis transversely and its outer end higher and more anterior than the inner, articulates with the glenoid fossa of the temporal bone. The neck of the condyloid process receives the insertion of the External pterygoid muscle internally. There is a tubercle on its external margin for the capsular and external lateral ligament of the lower jaw.

OSSIFICATION.—This bone ossifies from twelve centers; six for each lateral half.

ARTICULATION.—It articulates with the glenoid fossa of the two temporal bones.

ATTACHMENT OF MUSCLES.—There are fifteen pairs of muscles attached to this bone. TO THE RAMUS, the Masseter of the temporo-maxillary region, the Internal pterygoid and External pterygoid of the pterygo-maxillary region, and Temporal of the temporo-maxillary region; TO INTERNAL SURFACE OF THE BODY, the Genio-hyo-glossus and Genio-hyoideus of the lingual region, Mylo-hyoid of the supra-hyoid region, Digastric of the supra-hyoid region, and Superior constrictor of the pharynx; TO THE EXTERNAL SURFACE OF THE BODY, Depressor labii inferioris and Depressor anguli oris of the inferior maxillary region, Levator menti of the inferior maxillary region, Orbicularis oris of the

intermaxillary region. *Platysma myoides* of the superficial cervical region, and *Buccinator* of the intermaxillary region.

BLOOD SUPPLY.—Branches from the internal maxillary.

LESSON CLXXXIV.

1. **Masseter muscle** which has been described on page 520.

2. **Internal pterygoid** which has been described on page 529.

3. **External pterygoid** which has been described on page 529.

4. **Temporal muscle** which has been described on page 508.

5. **Genio-hyo-glossus**.—DESCRIPTION.—This muscle is fan-shaped and placed vertically on either side of the middle line of the jaw. The apex of this muscle is at its point of attachment to the lower jaw and its base is its insertion into the tongue and the hyoid bone. This muscle is more or less blended with its fellow in front but separated from it behind.

ORIGIN.—From the superior genial tubercle on the inner side of the symphysis of the jaw.

INSERTION.—Into the upper part of the body of the hyoid bone and median line of the tongue, the side of the pharynx, and the entire length of the under surface of the tongue.

ACTION.—To retract and protrude the tongue.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Lingual.

6. **Genio-hyoideus**.—DESCRIPTION.—This muscle increases in breadth as it passes towards its insertion and lies close to its fellow. It is situated beneath the inner border of the *Mylo-hyoid*.

ORIGIN.—From the inferior genial tubercle of the lower jaw.

INSERTION.—Into the anterior surface of the body of the hyoid bone.

ACTION.—To lift and draw forward the hyoid bone.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Lingual.

7. **Mylo-hyoid**.—

ORIGIN.—From the mylo-hyoid ridge of the lower jaw.

INSERTION.—Into the body of the hyoid bone and a median fibrous raphe running in mid-line of the hyoid bone to the chin.

ACTION.—Lifts the hyoid and draws it forward.

NERVE SUPPLY.—Mylo-hyoid branch of the inferior dental of the fifth.

BLOOD SUPPLY.—Submental and mylo-hyoid arteries.

8. **Digastric muscle** which has been described on page 521.

9. **Superior constrictor** which has been described on page 515.

10. **Depressor labii inferioris**, also called *Quadratus menti*.

ORIGIN.—From the external oblique line of the inferior maxillary bone below and internal to the mental foramen.

INSERTION.—Into the lower lip (facial part of the *Orbicularis oris*).

ACTION.—To draw the lower lip down.

NERVE SUPPLY.—Supramaxillary branch of facial nerve.

BLOOD SUPPLY.—Branches from the facial artery.

11. **Depressor anguli oris** (also called *Triangularis menti*).

ORIGIN.—From the external oblique line of the inferior maxillary bone between the attachments of the *Depressor labii inferioris* and *Platysma myoides*.

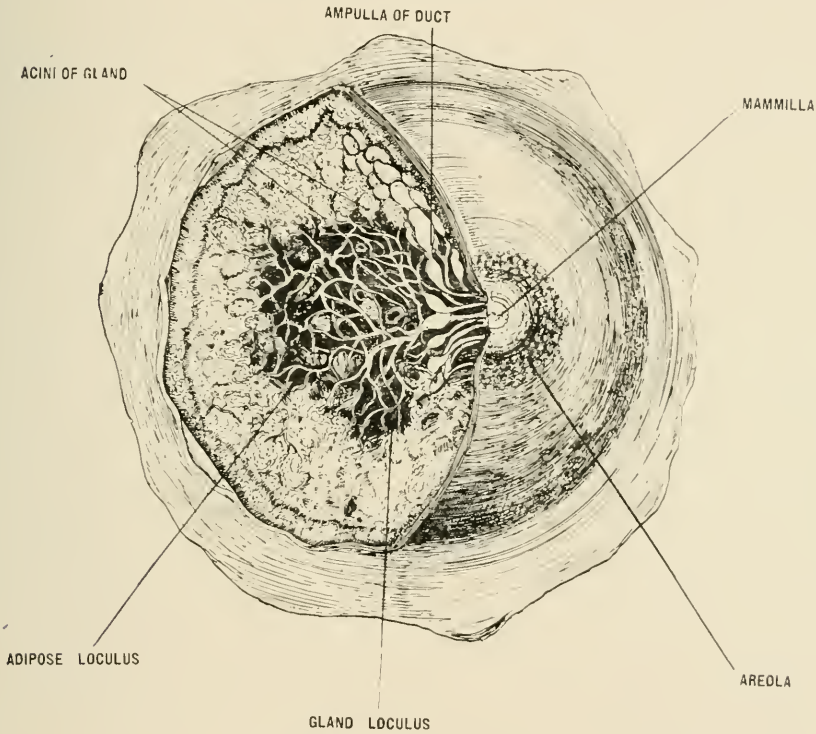
INSERTION.—Into the angle of the mouth.

ACTION.—To draw down the angle of the mouth.

NERVE SUPPLY.—Supramaxillary division of the facial.

BLOOD SUPPLY.—Branches of the facial artery.

PLATE CCLXXIX.



THE MAMMARY GLAND.

12. **Levator labii inferioris**, also called *Levator menti*.

ORIGIN.—From the incisive fossa of the inferior maxillary bone.

INSERTION.—Into the facial part of the *Orbicularis oris* and integument of chin.

ACTION.—To raise the lower lip.

NERVE SUPPLY.—Supramaxillary branch of the seventh.

BLOOD SUPPLY.—Branches of the facial artery.

13. **Orbicularis oris** which has been described on page 540.

14. **Platysma myoides**.—DESCRIPTION.—The *Platysma myoides*, which is a broad thin layer of muscle, lies in the superficial fascia.

ORIGIN.—From the deep fascia which covers the *Deltoid* and *Pectoralis*

major muscles, as it passes over the clavicle a few fibers may be attached to it.

INSERTION.—Into the fascia extending from the angle of the mouth to the angle of the jaw, also into the inferior maxillary bone below the mental foramen.

ACTION.—Helps to depress the lower jaw.

NERVE SUPPLY.—The inframaxillary division of the seventh.

BLOOD SUPPLY.—Branches of the external carotid artery.

15. **Buccinator** which has been described on page 540.

LESSON CLXXXV.

INFERIOR TURBINATED BONE. (Plates CCLX-CCLXIV.)

The **inferior turbinated bone**, which is situated in the nasal fossa along its outer wall, is curved upon itself. It has two surfaces, two borders, two extremities, and three processes.

The **external surface** of the inferior turbinated bone is concave, and helps to form the inferior meatus.

The **internal surface** of the inferior turbinated bone is convex.

The **extremities** of this bone are narrow and pointed.

The **inferior border** (free border) passes to within half an inch of the floor of the nose.

The **superior border** articulates with the inferior turbinated crest of the superior maxillary bone anteriorly, and with the inferior turbinated crest of the palate bone posteriorly.

The **lachrymal process** is on the superior border at the junction of the anterior one-fourth with the posterior three-fourths. It articulates with the inferior angle of the lachrymal bone and also with the nasal process of the superior maxillary bone, thus helping to form the nasal duct.

The **ethmoidal process** is on the superior border about half way between the lachrymal process and the posterior extremity of the bone. It articulates with the unciform process of the ethmoid.

The **maxillary process**, which is immediately below the ethmoidal process but on the external surface of the bone, articulates with the lower edge of the aperture of the antrum of Highmore, and also helps to close this opening.

OSSIFICATION.—It ossifies from one center.

ARTICULATION.—It articulates with four bones. The ethmoid of the cranium, superior maxillary, lachrymal, and palate of the face.

ATTACHMENT OF MUSCLES.—It has no muscles attached to it.

BLOOD SUPPLY.—

VOMER BONE. (Plate CCLXI).

The **vomer** (ploughshare) forms the postero-inferior part of the nasal septum and is a single bone. It has the following points for consideration:

The **naso-palatine grooves** or canals are situated on each side of this bone running downward and forward to the intermaxillary suture. They are for the naso-palatine nerves.

The **posterior border** of the vomer is concave and free. Its lower portion is thin, while its upper portion is divided.

The **inferior border**, which is the longest, articulates with the nasal crest of the superior maxillary and palate bone.

The **anterior border** is short and articulates with the incisor crests of the superior maxillary bone.

The **antero-superior border** receives the lower margin of the triangular cartilage below and the vertical plate of the ethmoid above.

The **postero-superior border** is the thickest and has a median groove which receives the rostrum of the sphenoid bone. This border is bounded on either side by the ala, which fits in the vaginal process of the sphenoid. This joint is a schindylesis.

OSSIFICATION.—This bone ossifies from one center.

ARTICULATION.—It articulates with six bones. The sphenoid and ethmoid of the cranium, the two superior maxillary, the two palate of the face. It also articulates with the cartilage of the septum.

ATTACHMENT OF MUSCLES.—It has no muscles attached to it.

BLOOD SUPPLY.—Anterior and posterior ethmoidal, and naso-palatine through Stenson's canal.

LESSON CLXXXVI.

PALATE BONE. (Plates CCLXII-CCLXIII-CCXXVIII-CCXXIX).

The **palate bones** are two in number and situated between the superior maxillary bones and the pterygoid processes of the sphenoid bone at the back of the nasal fossæ. Each bone helps to form the roof, floor, and outer wall of the nose, and the floor of the orbit. They also help to form the spheno-maxillary fissure, spheno-maxillary fossa, and the pterygoid fossa, and the zygomatic fossæ. Each one has the following points for consideration:

The **horizontal plate**, which is thick, has two surfaces and four borders.

The **superior surface** is concave transversely and forms the back part of the floor of the nose.

The **inferior surface** is also concave and forms the back part of the hard palate, and has upon it a transverse ridge for the attachment of the Tensor tympani aponeurosis. A groove is situated at the outer end of this transverse ridge which with the tuberosity of the superior maxillary bone forms the posterior palatine canal. Posterior to this groove are foramina of the accessory posterior palatine canals.

The **anterior border** is serrated and articulates with the palate process of the superior maxillary bone.

The **internal border** is thick and articulates with the internal border of its fellow, thus forming a groove on the upper surface for the reception of the vomer. On the posterior extremity of this border is a posterior nasal spine which is for the origin of the Azygos uvula muscle.

The **external border** joins the vertical plate of the palate bone at right angle.

The **posterior border** is free and concave, and gives attachment to the soft palate.

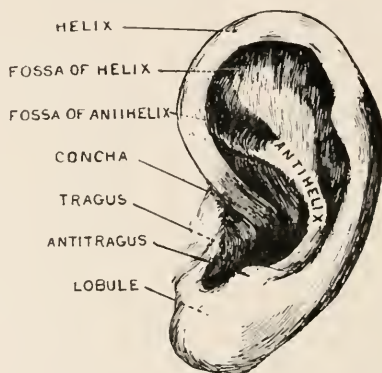
The **vertical plate** is broad and thick and is directed upward and slightly inward. This plate has two surfaces and four borders.

The **external surface** articulates with the superior maxillary bone for most of its extent. This part of the bone is rough. The front part of this surface is smooth and covers the orifice of the antrum of Highmore. The upper and back part of this surface helps to form the sphenomaxillary fossa and is also smooth. On the posterior part of this surface is a deep groove which with the superior maxillary bone forms the posterior palatine canal for the descending palatine vessels and the descending palatine nerve.

The **internal surface** forms part of the inferior meatus which is below the inferior turbinated crest. The superior turbinated crest articulates with the middle turbinated bone, and above this crest is the superior meatus, while between this crest and the inferior turbinated crest is the middle meatus.

The **inferior border** joins the horizontal plate at right angles.

PLATE CCLXXX.



THE OUTER SURFACE OF THE PINNA.

The **superior border** has a notch separating the sphenoidal process from the orbital process, and this notch is converted into the sphenopalatine foramen by the sphenoidal turbinated bone. The sphenopalatine vessels and the superior nasal and nasopalatine nerves pass through this foramen. It was stated above that this notch was converted into a foramen by the sphenoidal turbinated bone, but it may be converted into a foramen by the two processes meeting.

The **anterior border** has the maxillary process at the anterior extremity of the inferior turbinated crest. This process closes the antrum of Highmore posteriorly and inferiorly. This border articulates with the superior maxillary bone.

The **posterior border** has a deep groove and articulates with the pterygoid process of the sphenoid bone. The internal pterygoid muscle has part of its origin from a median groove on the lower part of this border which forms part of the pterygoid process.

The **orbital process** is triangular in shape and is directed upward and out-

ward. It has three articular surfaces and two free surfaces. The articular surfaces are THE ANTERIOR or maxillary, which articulates with the superior maxillary bone,—INTERNAL or ethmoidal surface, which articulates with the ethmoid bone,—and POSTERIOR or sphenoidal surface, which articulates with the sphenoidal turbinated bone. The free surfaces are THE ORBITAL, which forms part of the floor of the orbit,—and THE EXTERNAL or zygomatic surface, which forms part of the zygomatic fossa. This process has a rounded border which forms part of the speno-maxillary fissure.

The **sphenoidal process** is smaller than the orbital process and articulates superiorly with the body of the sphenoid, and externally with the pterygoid process of the sphenoid. It has three surfaces and two borders. THE INTERNAL SURFACE, which is concave, forms part of the outer wall of the nasal fossa—THE SUPERIOR SURFACE, which articulates with sphenoidal turbinated bone, is converted into the pterygo-palatine canal,—THE EXTERNAL SURFACE articulates with the inner surface of the pterygoid process of the sphenoid bone, and also helps to form the speno-maxillary fossa. ITS ANTERIOR BORDER forms the back part of the speno-palatine foramen. ITS POSTERIOR BORDER articulates with the inner surface of the pterygoid process.

OSSIFICATION.—This bone ossifies from one center.

ARTICULATION.—It articulates with six bones. The sphenoid, ethmoid, superior maxillary, inferior turbinated, vomer, and its fellow.

ATTACHMENT OF MUSCLES.—This bone has four muscles attached to it. The Tensor palati of the soft palate, Azygos uvulæ of the soft palate, Internal pterygoid of the pterygo-maxillary region, and Superior constrictor of the pharynx.

BLOOD SUPPLY.—Descending palatine, speno-palatine, and pterygo-palatine.

1. **Tensor palati**, which has been described on page 522.

2. **Internal pterygoid muscle**, which has been described on page 529.

3. **Azygos uvulæ.**—**DESCRIPTION.**—There is a pair of these muscles although from the name we might think there is but one. There is one on each side of the median line of the soft palate.

ORIGIN.—From the nasal spine of the palate bone and the adjacent apocerosis of the soft palate.

INSERTION.—Into the uvula.

ACTION.—To shorten the uvula.

NERVE SUPPLY.—Internal branch of spinal accessory, through the pharyngeal plexus.

BLOOD SUPPLY.—Palatine arteries from internal maxillary.

4. **Superior constrictor**, which has been described on page 515.

LESSON CLXXXVII.

HYOID BONE. (Plate XIX.)

The **hyoid bone**, which is situated at the base of the tongue consists of a body, two greater cornua, two lesser cornua, making it horse-shoe in shape. It is called the lingual bone. The **anterior surface** of the body is convex and

has a veriteal ridge in its center. There is a small tubercle on the upper end of this ridge. This surface has attached to it the following muscles: Genio-hyoid, Genio-hyo-glossus, Hyo-glossus, Mylo-hyoid, Stylo-hyoid, the aponeurosis of the Digastric muscle.

The **posterior surface** of the body is concave.

The **lateral surfaces** articulate with the greater cornua.

The **superior surface** gives attachment to the Genio-hyo-glossus, and Chondro-glossus.

The **inferior border** gives attachment to the Sterno-hyoid, Omo-hyoid, and Thyro-hyoid muscles. All muscles attached to this bone are in pairs.

The **greater cornu** projects backward and outward from the lateral surface of the body. The thyro-hyoid ligament is attached to the end of the greater cornu. The Hyo-glossus muscle is attached to its outer surface, the Middle constrictor to its upper border, and the Thyro-hyoid to its lower border.

The **lesser cornu** is situated at the angle where the greater cornu joins the body. The stylo-hyoid ligament is attached to its apex. This articulation may be ankylosed but is generally free.

OSSIFICATION.—From five centers.

ARTICULATION.—It articulates with no bone.

ATTACHMENT OF MUSCLES.—This bone has twelve pairs of muscles attached to it, as well as the thyro-hyoid membrane and the stylo-hyoid, thyro-hyoid, and hyo-epiglottic ligaments.

BLOOD SUPPLY.—Superior thyroid and lingual of the external carotid artery.

1. **Sterno-hyoid muscle**, which has been described on page 40.

2. **Thyro-hyoid.**—

ORIGIN.—From the oblique line on the thyroid cartilage.

INSERTION.—Into the body and the greater cornu of the hyoid bone.

ACTION.—To depress the larynx and the hyoid bone.

NERVE SUPPLY.—Hypoglossal nerve.

BLOOD SUPPLY.—Superior thyroid artery.

3. **Omo-hyoid muscle**, which has been described on page 59.

4. **Digastric muscle**, which has been described on page 521.

5. **Stylo-hyoid**, which has been described 522.

6. **Mylo-hyoid**, which has been described on page 544.

7. **Genio-hyoid**, which has been described on page 544.

8. **Genio-hyo-glossus**, which has been described on page 544.

9. **Chondro-glossus.**—**DESCRIPTION.**—This muscle is sometimes described as part of the Hyo-glossus.

ORIGIN.—From the body and lesser cornu of the hyoid bone.

INSERTION.—Into the intrinsic muscles of the tongue between the Hyo-glossus and the Genio-hyo-glossus.

ACTION.—To draw down the side of the tongue.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Lingual artery.

10. **Hyo-glossus.**—

ORIGIN.—From the whole length of the greater cornu and from the body of the hyoid bone.

INSERTION.—Into the side of the tongue.

ACTION.—To draw down the side of the tongue.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Lingual artery.

11. Middle constrictor.—

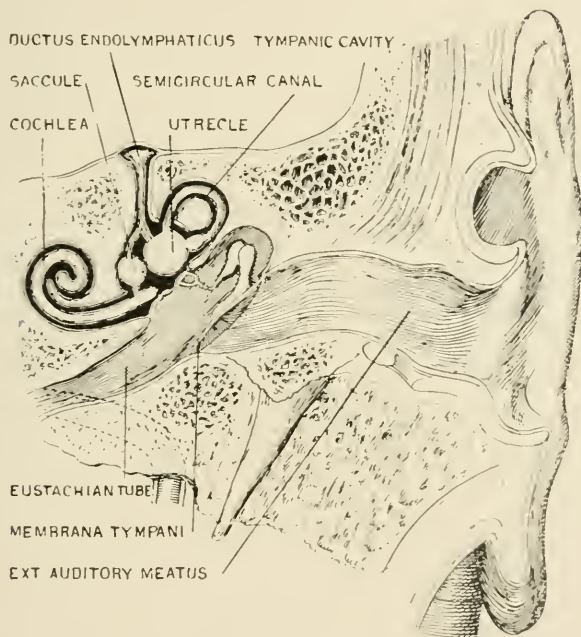
ORIGIN.—From the greater cornu of the hyoid bone and the stylo-hyoid ligament.

INSERTION.—Into the middle line of the pharynx by the fibrous raphe.

ACTION.—To constrict the pharynx antero-posteriorly.

NERVE SUPPLY.—Pharyngeal plexus.

PLATE CCLXXXI.



DIAGRAMMATIC VIEW OF THE ORGANS OF HEARING.
(MODIFIED FROM CUNNINGHAM.)

BLOOD SUPPLY.—Same as the blood supply to the pharynx, which is given on page 315.

12. *Inferior lingualis*.—This muscle runs along the under edge of the tongue in its whole length. It makes the dorsum convex and shortens the tongue.

LESSON CLXXXVIII.

THERE ARE THREE PAIRS OF MEATUSSES IN THE NOSE. (Plate CCLXIV).

The **superior meatus**, which is the smallest of the three, is situated be-

tween the superior turbinated bone and middle turbinated bone at the upper and back part of the nasal fossa. This meatus occupies the posterior one-third of the outer wall of the nasal fossa. The sphenopalatine foramen opens into it at the back part of its outer wall, while the posterior ethmoidal cells open into it at the anterior part of the outer wall. The sphenoidal recess is behind the superior turbinated bone at the superior and posterior part of the nasal fossa and opens into the sphenoidal sinus.

The **middle meatus** occupies the posterior two-thirds of the outer wall of the nasal fossa and is situated between the middle turbinated bone and the inferior turbinated bone. This meatus communicates anteriorly with the anterior ethmoidal cells by means of the infundibulum and through these cells with the frontal sinus. The opening of the antrum of Highmore is near the center of this meatus.

The **inferior meatus**, which is the largest of the meatuses, is situated between the inferior turbinated bone and the floor of the nasal fossa. It will be noticed that the superior meatus occupied the posterior one-third of the outer wall and the middle meatus occupied the posterior two-thirds of the outer wall, while the inferior meatus occupies the entire length of the outer wall of the nasal fossa. The canal for the nasal duct opens at the anterior extremity of this meatus.

The **nasal fossæ** extend from the base of the cranium to the roof of the mouth, and are situated on each side of the middle line of the face. They are two large cavities which are separated from each other by a thin septum. The anterior nares open on the front of the face from the nasal fossæ while the posterior nares open into the pharynx. The frontal sinus communicates with the nasal fossa above, the sphenoidal sinus communicates with the nasal fossa posteriorly, and the antrum of Highmore and the ethmoidal sinus communicate with it externally. The orbit is joined to the nasal fossa by the lachrymal groove. The mouth communicates with the nasal fossa by the anterior palatine canal. The cranium communicates with the nasal fossa by the olfactory foramina, and the sphenomaxillary fossa communicates with the nasal fossa by the sphenopalatine foramen. Sometimes the nasal fossæ communicate with each other by an opening in the septum. There are fourteen bones in the nasal fossæ. They include all the bones of the face except the two malar and the inferior maxillary, and in place of these three it has the frontal, ethmoid and sphenoid of the cranium. The ethmoid bone with all its articulations make the nasal fossæ. The frontal, ethmoid, and sphenoid are common to the nasal fossæ, cranium and the orbits.

There are **numerous foramina** at the base of the skull extending from the foramen cæcum to the foramen magnum. There are also three large fossæ at the base of the skull, namely, the anterior fossa, middle fossa, and the posterior fossa. (Plate CCXXXV.)

THE ANTERIOR FOSSA HAS THE FOLLOWING FORAMINA:

1. **Foramen cæcum** through which a vein passes to the superior longitudinal sinus, sometimes one from the frontal sinus. This is a single foramen, while the others in this fossa are in pairs.

2. The **ethmoidal fissure** through which passes the nasal nerve and the anterior ethmoidal vessels.

3. **Olfactory foramina** for the olfactory nerves and nasal branches of the ethmoidal arteries.

4. **Anterior ethmoidal foramen** for anterior ethmoidal vessels and nasal nerve.

5. **Posterior ethmoidal foramen** for posterior ethmoidal vessels and a branch of the nasal nerve.

6. **Optic foramen** for the optic nerve and the ophthalmic artery. This foramen is sometimes given as belonging to the middle fossa since it is on the boundary line between the anterior and middle fossa. Thus we can see that there are eleven sets of foramina in the anterior fossa; five pairs and a single one.

LESSON CLXXXIX.

THE MIDDLE FOSSA IS ON A LOWER LEVEL THAN THE ANTERIOR FOSSA AND HAS THE FOLLOWING FORAMINA ALL OF WHICH ARE IN PAIRS:

1. **Sphenoidal fissure** (anterior lacerated foramen) which transmits the third nerve, the fourth nerve, and three divisions of the ophthalmic division of the fifth nerve, and the sixth nerve, also filaments from the cavernous plexus, ophthalmic vein, recurrent branch from the lachrymal artery, orbital branch of the middle meningeal artery, and a process of the dura mater.

2. **Foramen rotundum** through which passes the superior maxillary division of the fifth nerve.

3. **Foramen Vesalii** which is for a small vein.

4. **Foramen ovale** through which passes the inferior maxillary division of the fifth nerve, small petrosal nerve, and the small meningeal artery.

5. **Foramen spinosum** through which passes the middle meningeal artery, meningeal veins, and filaments from the cavernous plexus.

6. **Foramen lacerum medium** through which passes the vidian nerve, a branch from the ascending pharyngeal artery, carotid artery, and carotid plexus.

7. **Hiatus Fallopii** through which passes the petrosal branch of the vidian nerve and the petrosal branch of the middle meningeal artery.

8. A **small foramen** through which passes the lesser petrosal nerve. Thus we see there are sixteen sets of foramina in the middle fossa.

THE POSTERIOR FOSSA IS ON A DEEPER LEVEL THAN EITHER OF THE OTHER FOSSAE AND CONTAINS THE CEREBELLUM AND THE MIDDLE FOSSA CONTAINS TEMPORO-SPHENOIDAL LOBES OF THE CEREBRUM AND THE ANTERIOR FOSSA CONTAINS THE FRONTAL LOBES OF THE CEREBRUM. THIS FOSSA HAS THE FOLLOWING FORAMINA:

1. The **meatus auditorius internus** for the facial and auditory nerves and the auditory artery.

2. The **aqueductus vestibuli** is for a small artery and vein and process of the dura mater.

3. The **jugular foramen** (foramen lacerum posterius) in which there are three compartments, through the anterior one of which passes the inferior

petrosal sinus, through the middle one passes the glosso-pharyngeal, pneumo-gastric, and spinal accessory nerves, through the posterior one the lateral sinus, and meningeal branches of the occipital, and ascending pharyngeal arteries.

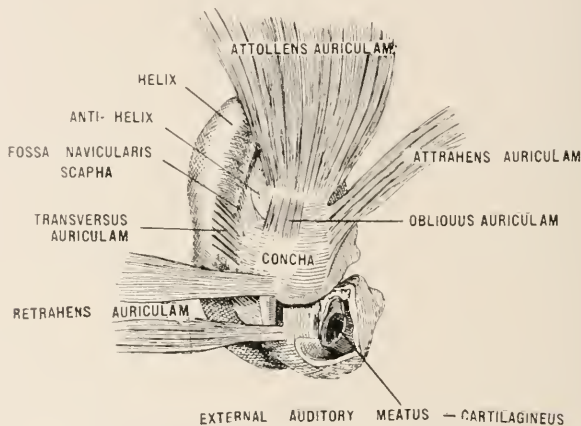
4. **Mastoid foramen** (often absent) is for a small vein and sometimes the mastoid artery.

5. The **anterior condyloid foramen** which is for the hypoglossal nerve, and meningeal branches of the ascending pharyngeal artery.

6. The **posterior condyloid foramen** (often absent) for posterior condyloid vein.

7. **Foramen magnum** which transmits the medulla oblongata and its membranes, spinal accessory nerves, vertebral arteries, anterior and posterior spinal arteries, and the occipito-axial ligaments. This foramen is a single one

PLATE CCLXXXII.



POSTERIOR VIEW OF THE EAR WITH AURICULAR MUSCLES.

and the others are in pairs. Thus we see there are thirteen foramina in the posterior fossa. The eleven in the anterior fossa, and sixteen in the middle fossa, and the thirteen in the posterior fossa make the forty foramina at the base of the skull.

LESSON CXC.

The **temporal fossa** (Plate CCXXXIV) is bounded anteriorly by the external angular process of the frontal bone, superiorly by the temporal ridges, posteriorly by the temporal ridges, inferiorly by the zygomatic arch. This fossa is separated from the zygomatic fossa by the pterygoid ridge which is on the outer surface of the greater wing of the sphenoid bone. The temporal fossa is formed by five bones, (1) part of the frontal bone, (2) greater wing of the sphenoid bone, (3) part of the parietal bone, (4) squamous portion of the temporal, (5) malar bone. It has the following sutures: (1) a part of the transverse facial suture, (2) spheno-malar suture, (3) coronal suture, (4) spheno-pari-

etal suture, (5) squamo-parietal suture, (6) squamo-sphenoidal suture.

The **stephanion** is the point where the coronal suture meets the temporal ridge.

The **pterion** is the point where the parietal, frontal, squamous portion of the temporal, and the greater wing of the sphenoid meet.

The **temporal fossa** is deep and concave anteriorly, but convex posteriorly. It is marked by grooves which lodge branches of the deep temporal arteries. The Temporal muscle fills this fossa.

The **zygomatic fossa** is bounded anteriorly by the tuberosity of the superior maxillary bone, posteriorly by the eminentia articularis and the posterior border of the external pterygoid process, superiorly by the pterygoid ridge which is on the outer surface of the greater wing of the sphenoid bone and separates this fossa from the temporal fossa, inferiorly by the alveolar border of the superior maxillary bone, externally by the zygomatic arch and the ramus of the lower jaw, internally by the external pterygoid plate. The internal maxillary artery, the inferior maxillary nerve and its branches, the External pterygoid muscle, the Internal pterygoid muscle, and the lower part of the Temporal muscle are situated in this fossa. The spheno-maxillary fissure and the pterygo-maxillary fissure are at the superior and internal part of this fossa.

The **spheno-maxillary fissure**, which opens into the outer and back part of the orbit, is horizontal in direction and is formed by the lower border of the orbital surface of the greater wing of the sphenoid superiorly, by the external border of the orbital surface of the superior maxillary bone and a small part of the palate bone inferiorly; by a small part of the malar bone externally; and it joins the pterygo-maxillary fissure at right angles internally. By means of this fissure the orbit communicates with the temporal fossa, zygomatic fossa, and the spheno-maxillary fossa. The superior maxillary nerve and its orbital branch, the inferior orbital vessels, and the ascending branches from Meckel's ganglion (spheno-palatine) are transmitted by this fissure.

The **pterygo-maxillary fissure** passes at right angles from the inner extremity of the spheno-maxillary fissure and is therefore vertical in direction.

It is formed by the separation of the superior maxillary bone from the pterygoid process of the sphenoid bone and is shaped like the letter V. It transmits the branches of the internal maxillary artery and connects the spheno-maxillary fossa with the zygomatic fossa.

The **spheno-maxillary fossa** is situated beneath the apex of the orbit where the spheno-maxillary fissure joins the pterygo-maxillary fissure. It is bounded by the under surface of the body of the sphenoid bone and orbital process of the palate bone superiorly, by the superior maxillary bone anteriorly, by the anterior surface of the base of the pterygoid process and lower part of the anterior surface of the greater wing of the sphenoid bone posteriorly, by the vertical plate of the palate internally. The sphenoidal fissure, the spheno-maxillary fissure, and pterygo-maxillary fissure open into it. The orbital fossa, nasal fossa, and the zygomatic fossa, and the cavity of the cranium communicate with this fossa. The foramen rotundum superiorly, the vidian foramen below and internal to the foramen rotundum, and the pterygo-palatine foramen open on

its posterior wall. The sphenopalatine foramen and the foramen of the posterior palatine canal open on its inner wall. Meckel's ganglion, the superior maxillary nerve, and the termination of the internal maxillary artery are in this fossa.

LESSON CXCI.

FEMALE ORGANS OF GENERATION. (Plates CCLXXI-CCLXXII-CCLXXIII).

The **internal female organs of generation** are, (1) the vagina, (2) the uterus (3) the Fallopian tubes, (4) the ovaries, while the external female organs of generation are known by the term vulva or pudendum.

The **vagina** is the sexual canal of the female which extends upward and slightly backward from the vulva to the uterus. Its upper extremity embraces the cervix uteri, the posterior wall reaching the cervix higher up than does the anterior wall. The anterior wall is two and three-fourths inches long, while the posterior wall is three and three-fourths inches long. These walls are in contact. There is a longitudinal ridge (carina) of the mucous membrane on the lower half of the anterior wall, while on the posterior wall there are two ridges called columnæ rugarum. From all three of these ridges transverse rugæ pass. In all the higher mammalia the vagina is the terminal section of a Mullerian duct or oviduct united with its fellow, while in the lower mammalia the vagina is double, wholly or in part there being two more or less complete vagina, the right and the left. In some oviparous animals, as birds, the termination of the oviduct beyond the uterine part receives the name of vagina.

The **hymen** is a crescentric or circular mucous fold which constricts the vagina at its entrance. When the hymen is ruptured warty eminences mark its site. These are called carunculæ myrtiformes. The hymen has the following forms:

1. **HYMEN BIFENESTRATUS** (biforis) is one in which there are two openings side by side and a broad septum between them.

2. **HYMEN CRIBRIFORMIS** is one in which the opening is filled by membrane pierced by many small openings.

3. **HYMEN DENTICULAR** is one in which the opening has serrate edges.

4. **HYMEN IMPERFORATE** is one which completely closes the vaginal orifice. In this condition a surgical operation, after commencement of the menstrual period, is necessary.

5. **HYMEN SCULPTURED** is one having an irregularly curved edge as if carved out of thickened tissue.

6. **HYMEN SEPTUS** is one in which the opening is divided by a narrow septum.

7. **HYMEN SUBSEPTUS** is one in which the opening is partly filled by a septum growing out of one wall but not reaching the other.

Although the hymen is most always ruptured by sexual congress it may remain unbroken until parturition.

The vagina is smallest below and largest where it surrounds the os uteri, where it is very dilatable.

The vagina has IN FRONT OF IT the urethra and the posterior wall of the bladder, BEHIND IT the anterior wall of the rectum and the pouch of Douglas,

ON EACH SIDE OF IT are the Levator ani muscles and the recto-vesical fascia.

THE VAGINA HAS THREE COATS:

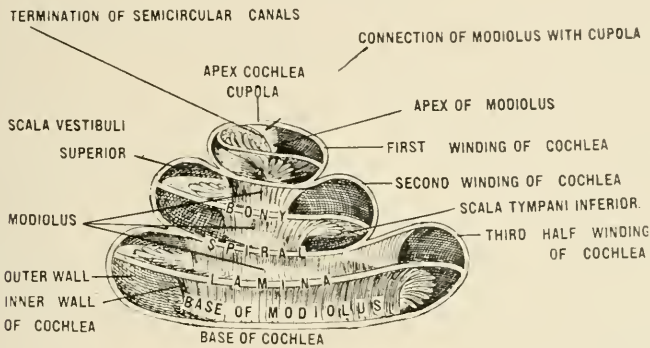
1. Outer or fibro-elastic. 2. Middle or muscular. 3. Mucous or internal.

The circular fibers near the entrance constitute the Sphincter vagina muscle which has been described on page 493.

The mucous lining of the vagina is covered with squamous laminated epithelium. It has no glands but is furnished with crypts and follicles, therefore the fluid which moistens it is the nature of a transudation rather than that of a secretion.

NERVE SUPPLY.—Hypogastric plexus, the fourth sacral, and the pudic cive.

PLATE CCLXXXIII.



THE BONY COCHLEA.

BLOOD SUPPLY.—A branch of the internal iliac artery, on either side, passing to the vagina and base of the bladder. This artery corresponds to the inferior vesical artery in the male. It also receives branches of the uterine artery.

LYMPHATICS of the vagina end in the pelvic inguinal nodes.

LESSON CXCH.

The **uterus** is that part of the female sexual passage to which a ripe ovum is conveyed from the ovary and in which it is detained in gestation until the fetus is matured and expelled in parturition. The non-pregnant human uterus is a pear-shaped organ about three inches long; with a broad flattened part above called the body and a narrow, more cylindrical part below called the cervix. Within is a cavity which passes out in the Fallopian tube on each side above and below opens into the vagina. The cavity narrows as it passes into the cervix at the internal os and continues downward to the cervical canal to terminate at the external os uteri or os tinea. The uterus is supported by the broad ligament which is a transverse fold of peritoneum and embraces it on each side. It has accessory ligaments, such as the round ligament, vesico-uterine ligament, and recto-uterine ligament. It consists of a serous or peri-

toneal coat, a middle coat of smooth muscular fibers forming most of its thickness, and an epithelial lining.

The **dimensions of the uterus** are as follows: about three inches in length, about two inches in breadth, and about an inch in thickness. The walls of the uterus are about three-eighths of an inch in thickness. In women who have borne children these dimensions are increased.

It **weighs** from seven to twelve drachms.

The **direction** of the uterus is towards the umbilicus, slightly to the right and forms an angle with the vagina close to ninety degrees, and as a rule the left superior angle is a little further forward than the right. The position of the uterus is changed when the bladder is full or when the rectum is full. In diseased conditions it may be **ANTEFLEXED** (an abnormal forward curvature); a form of displacement in which the upper part of the organ is bent forward, or we may have an **ANTEVERSION** (a forward tipping or tilting of the organ); a displacement in which the organ is tipped forward but not bent at an angle as anteflexion). It may be **RETROFLEXED** (bent backward), or there may be a **RETROVERSION** (the tipping of the entire organ backward).

The **fundus** of the uterus is broad and convex and is covered with peritoneum.

The **body** is flat anteriorly, convex posteriorly, and concave laterally. It is joined to the bladder by its lower anterior fourth. The posterior surface of the body is entirely covered with peritoneum, while in front the peritoneum covers its upper three-fourths.

The **cervix** is the lower constricted portion and is embraced by the upper extremity of the vagina.

The **cavity of the body** is triangular and flattened from before backward. This cavity has two lateral cornua above, and a constricted opening (internal os) at its lower angle.

The **cavity of the cervix** is spindle-shaped and has on its anterior and posterior walls longitudinal folds called *arbor vitæ*.

The **external os** is a transverse orifice at the lower end of the cavity of the cervix and opens into the vagina. It has an anterior lip and a posterior lip.

THE LIGAMENTS OF THE UTERUS ARE EIGHT IN NUMBER.

1. The **anterior ligament** (vesico-uterine) is a reflexion of the peritoneum from the front of the uterus on to the bladder.

2. The **posterior ligament** (recto-uterine) passes from the posterior wall of the uterus and over the upper one-fourth of the vagina and then to the rectum and sacrum, thus forming **THE POUCH OF DOUGLAS** which is behind the upper portion of the vagina.

3 and 4. The **two lateral** or broad ligaments are folds of peritoneum which pass from the sides of the uterus to the lateral walls of the pelvis, and thus form a septum across the pelvic cavity. The broad ligaments contain the Fallopian tubes, the round ligaments, the ovaries, the parovaria (organs of Rosenmüller), blood vessels and nerves, as well as connective tissue and unstriped muscle fibers.

5 and 6. The **two sacro-uterine** ligaments are folds of peritoneum which

pass from the sides of the uterus to the sides of the rectum first, then to the sacrum.

7 and 8. The **two round ligaments** are about five inches long and extend from the lateral aspect of the fundus of the uterus through the inguinal canals to the labia majora. They are composed of muscular tissue, areolar tissue, and fibrous tissue, as well as vessels and nerves.

The **canal of Nuck** is a tubule of peritoneum in the young female descending from the uterus into the inguinal canal. It is usually obliterated in the adult.

BLOOD SUPPLY.—(1) The uterine, which is a branch of the anterior division of the internal iliac artery, (2) funicular from the superior vesical, (3) the ovarian from the abdominal aorta.

NERVE SUPPLY.—From the inferior hypogastric and ovarian plexus of the sympathetic, and the third and fourth sacral nerves.

THE LYMPHATICS of the cervix end in the pelvic nodes, while those from the body end in the lumbar nodes.

The **coats of the uterus** are three, (1) a serous, (2) a muscular, and (3) a mucous.

THE SEROUS COAT is the peritoneum which invests the uterus, except at its lower anterior one-fourth.

THE MUSCULAR COAT, which is composed of smooth muscular fiber intermingled with the areolar tissue, blood vessels and nerves, forms the chief bulk of the uterus. The circular muscular fibers are most numerous in the cervix, while the longitudinal are most numerous in the body of the uterus.

THE MUCOUS COAT is very thick (one-eighth of an inch) is closely adherent to the internal muscular layer. It is pale and smooth, and has the openings of numerous glands upon its surface and is covered with ciliated columnar epithelium. The ovula of Naboth are glandules or follicles within the os uteri and cervical canal which are often distended with mucus, which mucus Naboth mistook for human ova, hence their name.

A laceration of the cervix in a DIATHESIS OF NEUROPATHIC CONSTITUTION is followed (1) by irritation, (2) indigestion, (3) malnutrition, (4) anemia, (5) neurosis.

LESSON CXIII.

The **Fallopian tubes** (oviducts) which serve to convey the ovum from the ovary to the uterine cavity, are two in number. Each one is about four inches long and one eighth of an inch in diameter and they are situated in the free or upper margin of the broad ligament, extending from the superior angles of the uterus to the superior or outer extremity of the ovary. One end of the Fallopian tube opens into the uterus at its superior external point, and the other end opens into the peritoneal cavity. Each tube is lined with ciliated columnar epithelium and its mucous lining is continuous with the uterine mucous membrane at one extremity and with the peritoneum at the other extremity. The mesosalpinx is the mesentery of the Fallopian tube and it is that part of the broad ligament between the tube and the ovary. Each tube increases in size from within outward and consists of the following parts:

1. The **isthmus** is the inner constricted third of the tube which is hard, cylindrical, and nearly horizontal. It is about an inch and a half long and one-eighth of an inch in diameter.

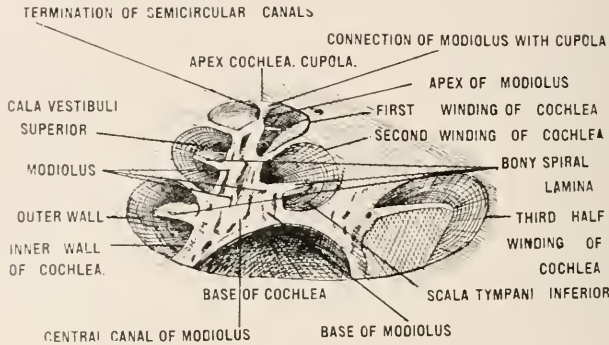
2. The **ampulla** (receptaculum seminis) is the outer dilated portion curving over the ovary and extends from the isthmus to the fimbriated extremity. Its diameter is about twice that of the isthmus and its walls are thinner and softer. The isthmus and the ampulla make the body of the tube.

3. The **Infundibulum** is the expanded outer end, the opening of which is the ostium abdominale.

4. The **fimbriae** are fringe-like processes which are arranged in two or three concentric circles. The fimbria ovarica is larger than its fellows and is attached to the superior extremity of the ovary.

5. The **hydatid of Morgagni** is the cyst like remnant of the Mullerian duct attached to the oviduct by a long stalk of peritoneum.

PLATE CCLXXXIV.



THE BONY COCHLEA CUT THROUGH.

NERVE SUPPLY.—The nerves are derived from a plexus around the uterine and ovarian arteries.

BLOOD SUPPLY.—The external tubular from the ovarian and the internal tubular from the uterine.

LYMPHATICS, after joining with those of the uterus, empty into the lumbar nodes.

The **ovaries**, which are the essential female organs of generation, are two grayish pink bodies situated in the broad ligament behind and below the Fallopian tube. The position of the ovary is indicated on the body by the mid-point of a line drawn from the anterior superior spinous process of the ilium to symphysis pubis.

The **dimensions of the ovary** are one and a half, by three-fourths, by one-third of an inch. They are not so dense as the testicle and in old age atrophy.

THE LIGAMENTS OF THE OVARY ARE:

1. The **utero-ovarian**, which is over an inch in length, connects the inferior extremity of the ovary with the superior angle of the uterus. This ligament

has in it fibrous tissue, plain muscular tissue which is derived from the superficial muscular layer of the uterus.

2. The **tubo-ovarian** (fimbria ovarica) joins the superior extremity of the ovary with the fimbriated extremity of the Fallopian tube.

3. The **suspensory** (lumbo-ovarian) is the upper part of the external border of the broad ligament.

In the **normal position** of the ovary, if their axes were continued, they would meet in front of the uterus. but the position of the ovary varies because the ligaments are attached to movable points. For instance, if the uterus turns to the right the ovary of that side is vertical and the ovary of the opposite side is nearly horizontal.

LESSON CXCV.

The **ovary consists** of a vascular stroma which contains the Graafian follicles.

The **stroma** is composed of connective tissue which has in it cells, white fibrous tissue, yellow elastic tissue, plain muscular fibers, blood vessels and nerves. From the hilum a core, called medullary substance, passes into the center of the ovary. It is composed of stroma and has passing from it numerous trabeculae to the cortex of the ovary, thus leaving spaces in which are situated Graafian follicles. The tunica albuginea is a condensed layer of the stroma which covers the ovary. The epithelial covering which surrounds the tunica albuginea is the remains of the germinal epithelium.

The **Graafian follicles** are the ova sacs which contain the ova. The majority of these Graafian follicles are microscopic, but when matured they become much larger. The smallest ones vary from $\frac{1}{800}$ to $\frac{1}{100}$ of an inch in diameter and the largest ones from $\frac{1}{20}$ to $\frac{1}{2}$ of an inch in diameter.

The **tunica fibrosa** encloses the blood trunks and lymphatic spaces of the follicle. This is the outer layer of the follicle.

The **tunica propria** is a vascular layer composed of connective tissue cells and capillary plexuses. This is the inner layer of the follicle.

The **membrana granulosa** is the cell layer which lines the inner surface of the Graafian follicle.

The **discus proligerus** is that part of the membrana granulosa in which the ovum is imbedded.

The **membrana propria** (vitalline membrane) is between the membrana granulosa and the tunica propria.

The **corpus luteum** is the yellow spot in the substance of the ovary and is caused by the rupture of the Graafian follicle, but it disappears when impregnation has not occurred. When impregnation has occurred it may undergo remarkable development.

The **true corpus luteum** (corpus luteum of pregnancy) is usually regarded as absolute proof of previous impregnation. The false corpus luteum (corpus luteum of menstruation) attains its greatest development in less than a week and begins to shrink in less than three weeks and completely disappears in a

few weeks. The true corpus luteum continues to grow for two or three months and may be as large as one-third of the entire ovary. It continues till toward the end of gestation and then shrinks to a small white scar which may not entirely disappear until a month after labor. While this is the general rule it does not always hold good for bodies which are identical with the TRUE CORPORA LUTEA have been found in the virgin ovaries.

The **ovary** in its descent may pass into the inguinal canal and out the external abdominal ring and become an external organ like the testicle. This is a very rare occurrence. At the third month of intra-uterine life the ovaries are situated in the lumbar region in front of the Psoas magnus near the kidney and by the ninth month they have descended to the brim of the pelvis. This is caused by the lumbar region growing away from the ovary.

NERVE SUPPLY.—The nerves are from the ovarian plexus of the sympathetic, and branches of the third and fourth sacral nerves.

BLOOD SUPPLY.—Ovarian from the abdominal aorta which corresponds to the spermatic in the male. The blood from the left ovary passes through its veins into the left renal vein, while the blood from the right ovary passes into the inferior vena cava.

LYMPHATICS from the ovary pass into the lumbar nodes.

LESSON CXCIV.

The external female organs of generation are known by the term vulva or pudendum and includes (1) the mons veneris, (2) the labia majora, (3) labia minora, (4) clitoris, (5) the orifice of the vagina.

The **mons veneris** (mount of Venus) is a round prominence at the symphysis pubes in the female, which is cushioned with fat and covered with hair.

The **labia majora** are hairy folds of the skin on either side of the slit of the vulva extending from the mons veneris to the perineum. Where they meet anteriorly they form the anterior commissure, and where they meet below they form the posterior commissure (fourchette) which is about an inch in front of the anus at the anterior boundary of the perineum. The fossa navicularis is between the posterior commissure and the hymen. THE NERVE SUPPLY of the labia majora is the superficial perineal from the pudic and the inferior pudendal from the small sciatic.

The **labia minora** (nymphæ) are folds of mucous membrane within the labia majora. They extend from the prepuce of the clitoris to the inner surface of the labia majora. They are not well developed until the age of puberty and are largest during pregnancy. The vestibule is the space between these lips and the orifice of the vagina.

The **clitoris**, which is situated at the anterior angle of the vulva is a small elongated erectile body of the female of most mammals. These mammals include the human species and numerous birds, as the ostrich. It differs from the penis of the male in that it is smaller and as a rule not perforated by a urethra, although it is in some animals, as lemurs. In the human female it is usually concealed in the normal state of the parts, but in the spider-monkey

it is quite large and it is difficult to distinguish it from the penis. It consists of the corpora cavernosa and the glans clitoridis.

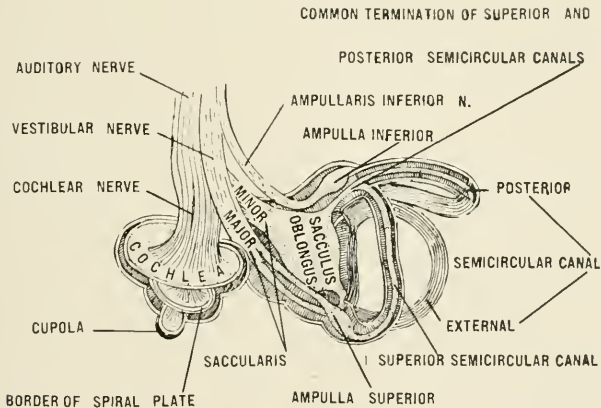
The **stalk hydatid** of Morgagni, when present in the female, is situated in the broad ligament at the outer extremity of the ovary. It is a small pedunculated sac, being a remnant of the pronephros. Its homologue in the male is the stalk hydatid of Morgagni, for which see, Plate CCLXXVI.

The **preputium clitoridis** is a fold, formed by the labia minora, covering the clitoris.

The **duct of Gartner** (a relic of the Wolffian duct) is a straight canal extending from the parovarium through the broad ligament to the vagina.

Bulbus vestibuli is a mass of erectile tissue situated on each side of the vestibule beneath the mucous membrane. It is homologous to the bulb of the corpus spongiosum in the male, while the pars intermedialis which is a continuation of the bulbus vestibuli anteriorly is homologous to the corpus spongiosum itself.

PLATE CCLXXXV.



THE INTERIOR OF THE LABYRINTH WITH DISTRIBUTION OF AUDITORY NERVE.

The **paroophoron** (parovarium) (organ of Rosenmuller) is a relic in the broad ligament of the urinary portion of the Wolffian body. It is a tubular body homologous to the organ of Giraldes (Paradidymis) in the male. It is present only in childhood and cannot always be recognized.

The **long tube of the parovarium** is homologous to the tube of the epididymis.

The **short tubules of the parovarium** are homologous to the rete testis and the coni vasculosi in the male.

Bartholin's glands are the vulvo-vaginal glands which are situated on each side of the vagina posteriorly to the bulbi vestibuli. They are small racemose glands about one-third of an inch long and each opens with a duct near the nymphae. Cowper's glands are the homologues of Bartholin's glands. See page 473. For description of the female urethra see page 474.

THE MAMMARY GLAND. (Plate CCLXXIX).

The **mammary glands** are named is zoology, from their position, axillary,

pectoral, ventral or abdominal, and inguinal. Sometimes they are quite high on the sides of the animal but are never dorsal. The mamma of the cow is situated in the median line, being formed from the coalescence of as many mammaræ as there are teats. These glands are paired as a rule and common to both sexes, but remain rudimentary and functionless in the male as a general thing. The male mammaræ have been known to secrete milk.

The **mammary gland of the human female** is situated between the third and sixth rib on each side between the sternum and the axilla. THE NIPPLE is situated between the fourth and fifth rib about four and one-half inches from the middle line of the sternum; but, of course, this position varies. The base of each nipple is surrounded by a zone of colored skin called THE AREOLA, and this areola has numerous small whitish tubercles which contain the openings of the sebaceous glands. The nipple is highly vascular and its skin is sensitive and contains retiform tissue and unstriped muscular fibers. There are about twenty orifices in the summit of the nipple which are the ends of the milk ducts. This gland is racemose and consists of from fifteen to twenty lobes, which are independent of one another. Each of these lobes is made up of lobules, and these are formed by the aggregation of alveoli in which the milk is secreted.

BLOOD SUPPLY.—The anterior intercostals, the external mammary (long thoracic), and acromio-thoracic arteries.

NERVE SUPPLY.—Anterior and lateral cutaneous branches of the intercostal nerves.

LYMPHATICS of the mammary gland pass into the axillary nodes.

The **Wolffian body** is the mesonephros or primitive kidney, the excretory organ of the embryo. It consists of a long tube in the lower part of the body-cavity, running parallel with the spinal axis and joined at right angles by a row of twisting tubes given off from the Malpighian body, and forming a structure resembling a comet. The Wolffian body develops into the head of the epididymis, vas deferens, and ejaculatory duct in the male.

LESSON CXCVI

THE MALE ORGANS OF GENERATION. (Plates CCLXXIV-CCLXXV-CCLXXVI-CCLXXVII-CCLXXVIII).

The **prostate gland** is shaped like a chestnut and is about one and one-half inches in its transverse diameter while it is one and one-fourth inches from base to apex. ITS WEIGHT is about the same as the testicle, (six drachms). THE APEX of this gland is at the triangular ligament. ITS BASE is at the neck of the bladder. Its posterior surface is joined to the rectum by areolar tissue. It has a dense firm CAPSULE which is derived from the recto-vesical fascia and the posterior layer of the triangular ligament. It consists of a median lobe and two lateral lobes. It is composed of glandular matter, and muscular fibers which encircle the urethra.

The **penis** is composed of a mass of erectile tissue enclosed in three rod-like segments which are firmly united together by a sheath composed of integument, dartos, and fascia. These segments are the two corpora cavernosa, and the corpus spongiosum. The root of the penis is attached to the symphysis and pudic arch. The body, which is triangular on cross section, forms the greater part of the free portion of the organ. The glans forms the expanded distal extremity of the organ and is more developed on the dorsal than on the ventral aspect, and the urethral opening is at its distal extremity. The glans is separated from the body by a constriction called the neck.

The **corpora cavernosa**, which lie side by side, form the upper and lateral parts of the penis. (Plate CCLXXIV). The crura are formed by the posterior one-fourth of the corpora cavernosa, Plate CCLXXV, and are attached to the tuberosities of the ischia and the descending rami of the ischia. The groove above the corpora cavernosa are for the dorsal vessels and dorsal nerves, while the groove below that is for the corpus spongiosum. The suspensory ligament of the penis is a fibrous membrane which connects the root of the organ to the symphysis pubes. The fibrous septum between the two corpora cavernosa, only present between its posterior two-thirds, is called septum pectiniform.

The **corpus spongiosum** lies in the groove between the corpora cavernosa inferiorly. This has no erectile tissue in it like the corpora cavernosa. It consists of glans, a body, and a bulb. The GLANS is somewhat heart-shaped and at its base is a ridge called corona glandis, behind which is the neck of the penis. THE EXTERNAL URINARY MEATUS is a vertical fissure about one-third of an inch in length at the apex of the glans. It is the outlet of the urethra. The body of the corpus spongiosum has passing through its whole length THE URETHRA. For description of the urethra see page 472, and for Plate page 533. THE BULB OF THE CORPUS SPONGIOSUM is surrounded by the Accelerator urinæ muscle. It passes posteriorly to within an inch of the anus. THE PREPUCE is a continuation of the integument of the penis which more or less completely conceals the glans. THE FRÆNUM PRÆPUTII is a fold of mucous membrane which connects the prepuce with the glans along the raphe. PHIMOSIS (muzzling or closure) is the tightness of the foreskin such that it cannot be drawn back from over the glans. PARAPHIMOSIS is a retraction of a narrow or inflamed foreskin which cannot be replaced. EPISPADIAS is a congenital defect in which the urethra opens on the dorsum of the penis. In female epispadias there is a fissure of the upper wall of the female urethra. HYPOSPADIAS is a congenital opening of the urethra on the under side of the penis. In the female hypospadias there is an opening of the urethra in the vagina.

The **dartos** is the reddish, cellular, contractile tissue beneath the skin of the penis and continuous with the dartos tissue of the scrotum. The female dartos is a layer of unstriped muscular fibers immediately under the skin of the labia majora. The dartos enters into the formation of the prepuce, and some authorities claim, forms a kind of a sphincter around the preputial orifice. The areolar tissue of the penis, which contains the superficial vessels and nerves, is just beneath the dartos. (Plate CCLXXIV). The deep fascia of the penis is beneath the areolar tissue. It is joined to the skin and the corpus

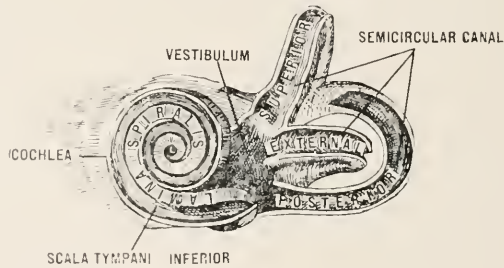
spongiosum. This fascia and the dartos aided by the Bulbo cavernosi and the Ischio-cavernosi muscles compress the veins of the penis in the action of erection.

BLOOD SUPPLY.—The arteries to the penis are branches of the internal pudic. (a) The artery of the bulb, which goes to the bulb of the corpus spongiosum, (b) the arteries of the corpora cavernosa, (c) the dorsal artery of the penis. THE ENVELOPS OF THE PENIS are supplied by the external pudic, the superficial perineal, and the dorsal artery. The veins of the penis are in two sets, (a) superficial veins, which pass between the dartos and fascial sheath and in the long saphenous and femoral veins, (b) the deep veins, which drain the corpora cavernosa, corpus spongiosum, end in the deep dorsal vein and in the internal pudic vein.

LYMPHATICS of the penis are divided into two sets, (a) superficial ones which pass to the inguinal nodes, and (b) deep ones which empty into the pelvic and lumbar nodes as well as in the inguinal nodes.

NERVE SUPPLY.—The genital branch of the genito-crural and the superficial perineal branches of the pudic supply the covering of the penis, while the dorsal nerve of the penis, and superficial perineal, and hypogastric plexus supply the erectile bodies.

PLATE CCLXXXVI.



INTERIOR OF BONY LABYRINTH.

The **spermatic cord** is about four inches long and extends from the internal abdominal ring to the globus minor of the epididymis. It passes through the inguinal canal. It is composed of the following structures held together by areolar tissue and invested by layers brought down by the descent of the testicle.

1. The **vas deferens**, which is the excretory duct of the testicle passing from the testis to the ejaculatory duct. It is recognizable by its cord-like resistance to pressure.

2. The **artery of the vas deferens**, which is a branch of the superior vesical artery. It arises from this artery near the place where the vas deferens crosses the obliterated hypogastric artery, and it divides into an ascending branch which follows the vas deferens through the inguinal canal, and a descending branch which passes to the dilated portion of the vas deferens and the vesicula seminalis.

3. The **cremasteric artery**, which is a branch of the deep epigastric, passes

through the inguinal canal with the vas deferens and supplies the Cremasteric muscle.

4. The **spermatic artery**, which is a branch of the abdominal aorta, passes over the Psoas muscle to the internal abdominal ring, then through the inguinal canal into the scrotum to the testicle. It gives off the following branches, (a) ureteral branches to the ureter, (b) cremasteric branches to the Cremasteric muscle, (c) epididymal to the epididymis, (d) testicular branches to the body of the testis.

5. The **spermatic veins**, or pampiniform plexus, surrounds the artery.

6. Spermatic plexus of nerves (sympathetic) accompanying the artery.

7. The **vas aberrans** is a blind tube connected with the epididymis or vas deferens. Its homologue is the duct of Gartner in the female.

8. The **lymphatics** which pass with the veins.

9. The **Internal cremasteric muscle**, which is composed of smooth muscular fibers.

10. The **obliterated processes vaginalis** of the peritoneum, which is a relic of the tube between the tunica vaginalis and the peritoneum.

11. A **branch** of the ilio-inguinal nerve.

12. A **branch** of the genito-crural nerve.

LESSON CXCVII.

The **infundibuliform fascia** which is from the transversalis fascia, the **cremasteric fascia** which is from the Internal oblique muscle, the **intercolumnar fascia** which is from the external spermatic fascia, the **superficial fascia** and the **skin** of the scrotum, all these are coverings of the spermatic cord from within outward.

The **vesiculæ seminales** are two lobulated membranous pouches between the base of the bladder and the rectum, and they serve as reservoirs for the semen, as well as secrete the fluid which is added to the semen. They have three coats, an external or fibrous coat, a middle or muscular coat, and an internal or mucous coat.

The **ejaculatory duct** is about an inch long and is formed by the union of the vas deferens and the vesicula seminalis. Its diameter is about one-eighth of an inch above, but where it opens it is about one-fiftieth of an inch. It opens on the veru montanum on either side of the opening of the sinus pocularis.

The **testicles** are two in number and are suspended by the spermatic cords. They weigh less than an ounce and are about an inch and a half long, and inch and a quarter deep, and about an inch in thickness. They secrete the seminal fluid. They have the following coverings from within outward.

1. The **tunica vaginalis**, which is a serous covering formed by a portion of the peritoneum which descended with the testicle and afterwards forms a closed pouch investing it. This tunica consists of two layers, a visceral and a parietal layer. Beneath the tunica vaginalis is the tunica albuginea which is a strong fibrous coat (Plate CCLXXVII); and beneath this coat, the tunica vasculosa (pia mater testis) which is composed chiefly of blood vessels held together by

areolar tissue. This coat lines the tunica albuginea and the various septa within the testicle.

2. The **infundibuliform fascia** (internal spermatic) is the fascia propria and is a continuation downward of the transversalis fascia.

3. The **cremasteric fascia** (middle spermatic fascia) is composed of muscular fibers (the Cremaster muscle) which are derived from the lower border of the Internal oblique muscle.

4. The **intercolumnar fascia** (external spermatic) which is closely-adherent to the dartos.

5. The **scrotum** consists of two layers, (a) the integument which is more or less pigmented and covered in the adult with scattered hair. A raphe is present in the median line from which pass transverse wrinkles. (b) The dartos which is a reddish, cellular, contractile tissue beneath the skin of the scrotum.

1. The **epididymis** (upon the testis) lies at the posterior and superior part of the testicle and consists of the globus minor which contains the efferent duct, and the globus major composed of vasa efferentia and coni vasculosa. If the epididymis were unraveled it would be a tube twenty feet long.

The **lobules** of the testicle are contained in the spaces formed by the trabeculae which divide the testicle into divisions. These lobules consist of the **tubuli seminiferi** which consist of a basement membrane lined with a layer of cuboidal cells in which are developed the spermatozoa. The tubuli at the apices of the lobules become straight and join the vasa recta which join the rete testes in the mediastinum, the rete testes end in the **vasa efferentia** which perforate the tunica albuginea and form the coni vasculosa.

Gubernaculum testis is a fetal cord attached to the lower end of the epididymis and to the bottom of the scrotum. It governs the descent of the testicle. Its homologue is the round ligament of the female.

The **paradidymis** (organ of Giraldes) is on the spermatic cord above the epididymis. It represents the remains of the posterior part of the Wolffian body. It is a closed tube. Its homologue is the paroophoron in the female.

The duct of Rathke is a part of the duct of Muller which persists in post-natal life and remains patulous. The oviduct is the homologue of the duct of Rathke.

The sessile hydatid of Morgagni is the upper part of the duct of Muller, which persists and is attached to the upper aspect of the testicle. The fimbria of the oviduct is the homologue of the sessile hydatid of Morgagni.

LESSON CXCVIII.

THE ORGANS OF HEARING. (Plates CCLXXX-CCLXXXVII, inclusive).

These organs consist of three portions.

1. The **external ear**, which consists of (a) pinna or auricle which is not of much importance physiologically, and (b) the meatus auditorius externus, which is a canal leading inward to the tympanic membrane.

2. The **middle ear**, which is composed of (a) the tympanum (an air chamber) containing the malleus, incus, and stapes (the auditory ossicles) and com-

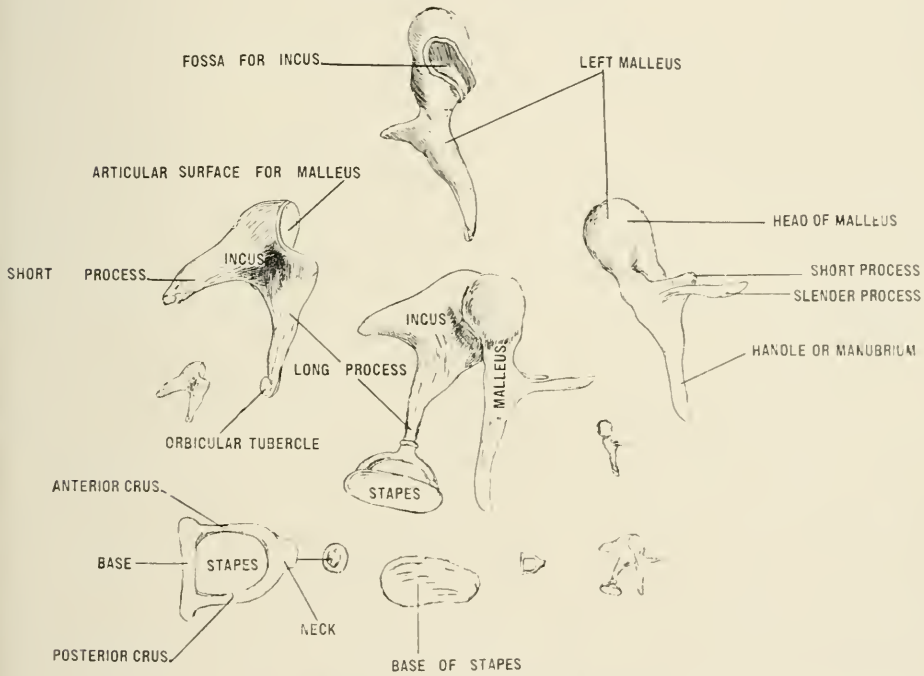
municates with the naso-pharynx by means of the Eustachian tube, (b) the mastoid antrum, (c) the mastoid cells. (b) and (c) are accessory air chambers to the tympanum.

3. The **internal ear** or labyrinth, contains the membranous labyrinth which is a cast of the bony structures. The membranous labyrinth contains the endolymph, and within it are the specialized neuro-epithelial cells and the terminations of the auditory nerve. The perilymph is on the outside of the membranous labyrinth.

THE EXTERNAL EAR.

The **pinna** is the projecting part of the ear lying outside of the head, and is attached to the malar and temporal bones by ligaments. It consists of a layer of yellow fibro-cartilage covered with integument. It has the following parts.

PLATE CCLXXXVII.



MALLEUS, INCUS AND STAPES.

1. The **helix** is the outer curved edge of the pinna which passes upward from the rim of the pinna and ends behind in the lobule.
2. The **lobule** is the lowest portion of the auricle and consists of fatty and areolar tissue.
3. The **fossa** of the helix (scaphoid fossa) is a depression internal to the helix.
4. The **antihelix** is a range which begins above the lobule at the anti-tragus and passing upward bifurcates to enclose a triangular depression called the fossa of the antihelix.

5. The **concha** is the deep hollow in the center of the pinna which leads into the auditory canal.

6. The **tragus** is a conical eminence in front of the concha projecting backward over the orifice of the external auditory meatus. It is usually covered with hair along its inferior border.

7. The **antitragus** is a small projection posterior to the tragus from which it is separated by a deep fissure called the *incisura intertragica*.

The muscles of the external ear are divided into two sets, THE **EXTRINSIC** and THE **INTRINSIC**. The extrinsic are, the *Attrahens aurem*, *Retrahens aurem*, and *Attollens aurem*. These muscles have been described on page 522 and in the table of muscles in the back of the book.

THE **INTRINSIC MUSCLES** ARE:

1. **Tragicus**, which lies vertically on the outer surface of the tragus.

2. **Antitragicus** lies on the posterior wall of the auditory canal. It arises from the outer part of the antitragus and passes upward to be inserted into the posterior extremity of the helix.

3. **Helicis minor** is often absent, but when present is attached to the commencement of the helix and extends into the concha.

4. **Helicis major** is situated on the anterior margin of the helix.

5. **Transversus aurem** is situated on the posterior surface of the auricle in the depression between the helix and the convexity of the concha.

6. **Obliquus aurem** is on the posterior surface of the auricle passing upward from the convexity of the concha.

NERVE SUPPLY.—From the auriculo-temporal, auricularis magnus, occipitalis minor, and Arnold's nerve from the tenth. The intrinsic muscles receive the seventh nerve.

ACTION of the Intrinsic muscles is to retard the passage of sound to the meatus. These muscles are rudimentary and unimportant.

BLOOD SUPPLY.—The pinna receives the posterior auricular, the occipital, and superficial temporal arteries.

LYMPHATICS of the pinna empty into the preauricular nodes, and into the nodes upon the insertion of the Sterno-cleido-mastoid muscle.

The **external auditory canal** is a little over an inch long, extending from the concha to the *membrana tympani*. This canal is curved with its convexity upward. This canal is lined with integument which contains sebaceous and ceruminous glands and also numerous hair follicles.

The outer one-third of this canal is cartilaginous, and the inner portion osseous.

The *Annulus tympanicus* is the osseous portions of this canal at birth, at which time it is an incomplete bony ring.

BLOOD SUPPLY.—From branches of the internal maxillary, posterior auricular, and superficial temporal.

NERVE SUPPLY.—Auriculo-temporal, auricularis magnus, and Arnold's nerve.

THE **LYMPHATICS** of the external auditory meatus end in the parotid and the posterior auricular nodes.

The **membrana tympani**, which is attached to a grooved ridge of bone at the bottom of the external auditory meatus, is an oval, elastic, semi-transparent membrane about $\frac{1}{24}$ of an inch in thickness, about $\frac{5}{12}$ of an inch in its antero-posterior diameter and slightly less in its vertical diameter. This membrane is situated obliquely, its outer surface being directed outward, downward, and forward, so as to form almost a continuation of the posterior wall of the external auditory meatus. In infancy this membrane is almost horizontal. The **membrana tympani** is composed of three layers: an outer or cutaneous layer, a middle or fibrous layer, and an inner or mucous layer. It has the following points for consideration:

1. The **umbo** (naval) is the dark depressed center of the membrane.
2. The **cone** of light is a triangular area, the apex of which is attached to the tip of the handle of the malleus, and at its base extends toward the circumference of the membrane. This is of value in diagnosis of diseases of the tympanum and **membrana tympani**.
3. The **tubercle** which is at the upper border is formed by the short process of the malleus.
4. The **stripe** which runs down from the tubercle to the umbo and is formed by the handle of the malleus.
5. **Sharpenell's membrane** (*membrana flaccida*) is situated at the upper part of the membrane below the notch of Rivini. This notch is formed where the bony ring to which the tympanic membrane is attached is incomplete.
6. **Rivinian foramen** is a minute opening which exists in Sharpenell's membrane.
7. **Membrana tensa** is all the tympanic membrane except the *membrana flaccida*. This membrane is concave externally.

BLOOD SUPPLY.—From tympanic branches of the internal maxillary and carotid arteries.

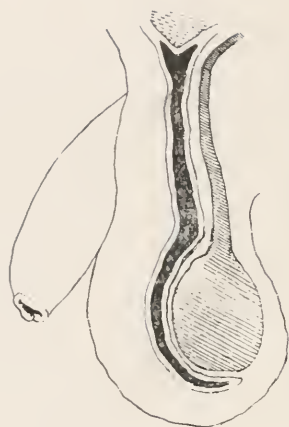
NERVE SUPPLY.—The external surface receives the auriculo-temporal from the fifth nerve and Arnolds' nerve from the tenth. The internal surface receives branches from the tympanic plexus.

LESSON CXCIX.

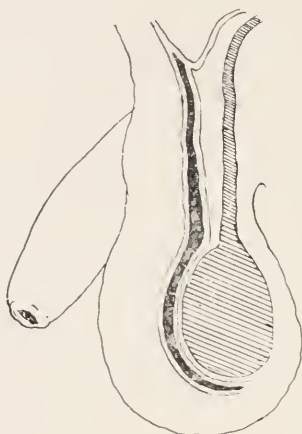
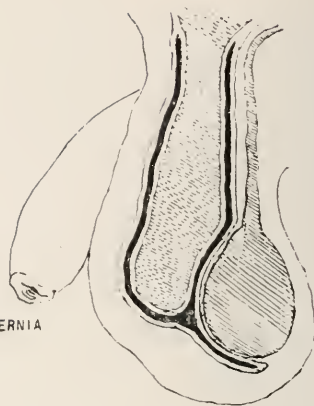
THE MIDDLE EAR.

The **tympanum** (drum) is an irregular cavity situated within the petrous portion of the temporal bone, and lined with mucous membrane. It lies between the external auditory meatus and the internal ear. Its antero-posterior length is about half of an inch, vertically a little more than half an inch, and its width is about one sixth of an inch. It consists of two main parts, (a) attic or recessus epitympanicus which is situated in the highest portion of the tympanic cavity and contains the head of the malleus and the greater part of the incus. This attic leads into the mastoid antrum. (b) Atrium (tympanic cavity proper) is situated opposite the tympanic membrane.

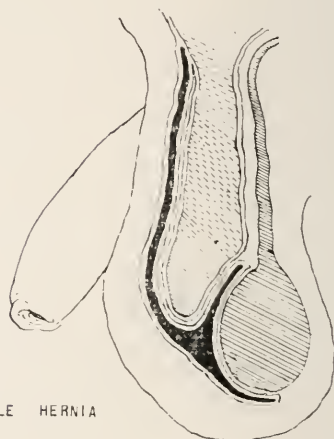
The **roof of the tympanum** is a thin plate of bone (*tegmen tympani*) which separates the tympanum from the middle fossa at the base of the skull.



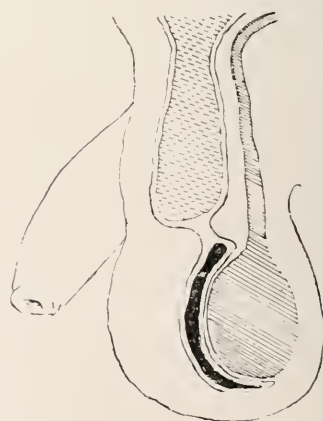
ENCYSTED HERNIA



INFANTILE HERNIA



HERNIA INTO THE TUNICA VAGINALIS



HERNIA INTO THE FUNICULAR PROCESS

FORMS OF CONGENITAL HERNIÆ (AFTER DEAVER.)

The **floor of the tympanum** is formed by the thin plate of bone which separates the tympanum from the jugular fossa.

The **anterior wall of the tympanum** is deficient above where the Eustachian tube opens into it. This wall separates the tympanum from the carotid canal and has opening of canal for Tensor tympani muscle above, and below the opening of the Eustachian tube. These canals are separated from one another by the processus cochleariformis.

The **posterior wall of the tympanum** separates the tympanum from the mastoid cells and communicates with the mastoid antrum by one large and several small openings.

The **outer wall of the tympanum** is formed by the membrana tympani and by the squamous portion of the temporal bone above. It has the following points for consideration:

1. THE ITER CHORDÆ POSTERIUS, which is close to the posterior edge of the drum head. The chorda tympani nerve which is a branch of the seventh cranial nerve enters the tympanum through this opening.

2. THE ITER CHORDÆ ANTERIUS, which is just above the drum head, is the opening by which the chorda tympani nerves leaves the tympanum.

3. THE GLASERIAN fissure, which opens above and in front of the head, lodges the long process of the malleus, the Laxator tympani muscle, and the tympanic branch of the internal maxillary artery.

The **inner wall of the tympanum** is the outer wall of the labyrinth and presents several points for consideration.

1. THE FENESTRA OVALIS leads to the vestibule and is closed by a membrane which is attached to the base of the stapes.

2. THE FENESTRA ROTUNDA is below the fenestra ovalis and leads into the scala tympani of the cochlea. It is closed by the membrana tympani secundaria.

3. THE PROMONTARY is an elevation formed by the first turn of the cochlea. It is covered by the tympanic plexus and is located between the two fenestræ and in front of them.

4. THE PYRAMID is behind the fenestra ovalis and from its summit passes the tendon of the Stapedius muscle, and a branch of the seventh nerve pierces the pyramid to supply the Stapedius.

5. THE RIDGE OF THE AQUEDUCTUS FALLOPII, which is above the fenestra ovalis and covers the seventh nerve in its passage through the tympanum.

BLOOD SUPPLY.—Tympanic branch of the internal maxillary artery, tympanic branch of internal carotid artery, stylo-mastoid branch of the posterior auricular artery, petrosal branch of the middle meningeal artery, a branch of ascending pharyngeal artery which enters through the Eustachian tube, tympanic branch of vidian artery. The veins of the middle ear follow the corresponding arteries and empty into the temporo-maxillary vein, the superior petrosal sinus, the lateral sinus, the internal jugular vein and pharyngeal veins.

The lymphatics of the middle ear end in the posterior auricular and carotid nodes.

NERVE SUPPLY.—Tympanic plexus which supplies the mucous membrane

of the tympanum and is formed by the following nerves: (1) Jacobson's nerve, (2) great superficial petrosal nerve, (3) small superficial petrosal nerve, (4) small deep petrosal.

The **middle ear** or tympanum is filled with air and contains the malleus, incus and stapes. These form a chain of bones which transmits the impulses of sound waves between the tympanic membrane and the parilymph and endolymph of the internal ear.

The **malleus** (hammer) consists of the following parts, (1) a head, (2) a neck, (3) a short process, (4) long process (process gracilis) (5) handle (manubrium). The handle is connected with the middle layer of the drum head and is situated between this middle and mucous layer. The short process (process brevis) is attached to the Tensor tympani muscle. The long process is received into the Glaserian fissure. The head, which is situated in the attic, is connected with the roof of the attic by the superior ligament of the malleus and it articulates with the body of the incus.

The **Incus** (anvil) has the following parts, (1) a body (head), (2) a long process, (3) a short process. The body articulates with the head of the malleus. This joint is covered by a capsular ligament and lined by synovial membrane. The short process articulates with the fossa incudis in the attic to which it is connected by fibrous tissue. The long process articulates with the head of the stapes. The end of this process is called os orbiculare. This os orbiculare is the smallest bone in the body. In adult life it forms part of the incus.

The **stapes** (stirrup) has the following parts, (1) a head, (2) a neck, (3) a base (foot piece), (4) two crura (branches). The head articulates with the os orbiculare of the incus. This is a ball-and-socket joint.

The base fits on the membrane closing the fenestra ovalis. The neck receives the tendon of the Stapedius.

The ligaments of the malleus, incus, and stapes are five besides the capsular ligaments of their articulations.

1. THE SUPERIOR LIGAMENT OF THE MALLEUS is a fibrous band passing from the head of the malleus to the outer part of the roof of the attic.

2. THE ANTERIOR LIGAMENT OF THE MALLEUS is attached to the anterior wall of the tympanum and to the anterior part of the head and neck of the malleus. It is sometimes described as the Laxator tympani muscle.

3. THE EXTERNAL LIGAMENT OF THE MALLEUS is attached to the neck of the malleus by its apex and to the margin of notch of Rivini by its base.

4. THE INTERNAL LIGAMENT OF THE MALLEUS extends from the tip of the processus cochleariformis to the insertion of the Tensor tympani tendon.

5. THE LIGAMENT OF THE INCUS is attached to the short process of the incus and to the posterior wall of the attic near the orifice of the mastoid antrum.

Besides these five ligaments just named we have capsular ligaments around the joints between the malleus and incus, and between the incus and stapes.

The **muscles of the tympanum** have been described on page 523.

The **mastoid antrum** is situated posterior to the tympanum and is lined with mucous membrane. It opens in the attic of the tympanum and into the mastoid cells.

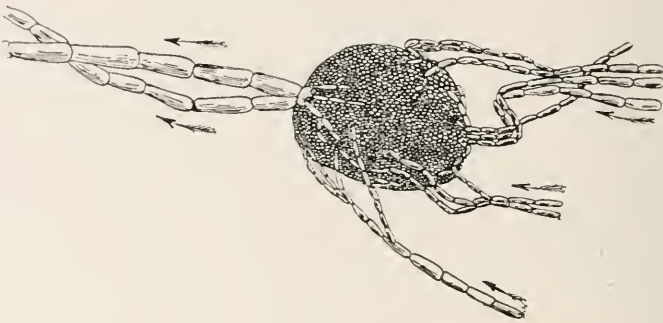


THE LYMPHATIC MAN.

The **mastoid cells** are not present at birth but at the age of puberty there are a few and they occupy the greater portion of the mastoid process. They are secondary organs of hearing.

The **Eustachian tube** is a passage from the naso-pharynx to the tympanum. It passes inward, downward, and forward from the tympanum. It is between an inch and a half and two inches long and from one-twelfth to one-fifth of an inch in diameter. It is made up of a bony part which is smaller than the cartilaginous portion and situated in the temporal bone, and of a cartilaginous portion which is somewhat trumpet-shaped ending in the pharynx. Its purpose is to equalize the air pressure within the tympanum with that of the external ear. At the point where the bony portion joins the cartilaginous portion is the isthmus tubæ. The opening of the Eustachian tube into the tympanum

PLATE CCXC.



A LYMPHATIC NODE (AFTER GERRISH.)

is on the anterior wall, while its pharyngeal opening is on the lateral wall of the naso-pharynx behind the posterior nares. This tube is closed except during swallowing, when it is opened by the following muscles: Tensor palati Levator palati, Salpingo-pharyngeus, and part of the Palato-pharyngeus.

LESSON CC.

THE INTERNAL EAR. (Labyrinth).

This **ear** consists of a bony labyrinth within which is the membranous labyrinth.

The **bony labyrinth** is made up of THE VESTIBULE, THE COCHLEA, and THE SEMICIRCULAR CANALS.

The **membranous labyrinth** is smaller than the bony labyrinth of which it is a cast and the space between the two is lined with endothelium which contains perilymph. The parts which make the membranous labyrinth are, THE UTRICLE which is a membranous sac in the vestibule, SACCCLE which is also a membranous sac in the vestibule, MEMBRANOUS SEMICIRCULAR CANALS which are in the osseous canals, and THE MEMBRANOUS COCHLEA which is a spirial tube inclosed in the osseous cochlea.

The **eighth nerve** (auditory) which is the portio mollis of the seventh nerve. This nerve has no neurilemma.

The **organ of Corti** is the terminal auditory apparatus in the membranous cochlea.

The **internal auditory meatus** is the opening into the internal ear from the cranial cavity for the seventh and eighth nerve and stylo-mastoid artery.

The **vestibule** is an oval cavity at the entrance to the cochlea within the internal ear. Vertically it is about one-fifth of an inch, laterally about one-tenth of an inch. It contains a fluid called perilymph and the utricle and saccule, and membranous labyrinth. It is situated between the cochlea and the semicircular canals internal to the tympanum. It has the following points for consideration:

1. The **FENESTRA OVALIS** is on its outer or lateral wall and communicates with the tympanum. It is closed by the base of the stapes and its annular ligament which is from the periosteal lining of the vestibule.
2. The **FOVEA HEMISPHERICA** is a small circular depression at the inner portion of the inner or median wall at the bottom of which are numerous small openings for the vestibular branch of the auditory nerve.
3. The **CRISTA VESTIBULI** is posterior to the fovea hemispherica. It is a vertical crest.

The **FOVEA COCHLEARIS** is a small depression which is perforated for the passage of the filaments of the auditory nerve.

5. The **AQUEDUCTUS VESTIBULI** is on the posterior portion of the inner wall. It transmits a small vein and lodges the ductus endolymphaticus which connects the membranous labyrinth with the general cerebral lymph spaces.

6. The **FOVEA HEMIELLIPTICA** is an oval fossa on the roof.

In the posterior portion of the vestibule are the five openings of the semicircular canals, while at the anterior portion of the vestibule is an opening leading into the scala vestibuli of the cochlea.

The **semicircular canals** are three C-shaped bony tubes about one-twentieth of an inch in diameter which are situated above and behind the vestibule.

1. The **SUPERIOR SEMICIRCULAR CANAL** is nearly an inch long and lies in a sagittal plane of the body.
2. The **EXTERNAL SEMICIRCULAR CANAL** is about one-fifth of an inch long and lies horizontally.
3. The **POSTERIOR SEMICIRCULAR CANAL** is nearly an inch long and lies in a coronal plane. From this we can see that the three semicircular canals are at right angles to one another and each forms more than a semicircle. The ampulla is about one-tenth of an inch in diameter.

The **cochlea** is a bony tube about one and a half inch long situated anteriorly to the vestibule. It resembles a snail shell and coils around a central axis two and three-fourths times. It has the following points for consideration:

1. The **MODIOLUS** (central axis) around which is wound a spiral tube. This axis has numerous canals in it for branches of the auditory nerve and artery, the largest one of these canals is canalis centralis modioli.
2. The **BASE OF THE COCHLEA** is two-fifths of an inch in diameter and is

perforated by numerous foramina for branches of the auditory nerve. It is directed toward the meatus auditorius internus.

3. THE SPIRAL CANAL (canalis spiralis modioli) is the space between the modiulus and the outer wall of the cochlea. It diminishes in diameter as it approaches the apex of the cochlea and ends in a closed extremity (cupola) after making two and three-fourths turns.

4. THE LAMINA SPIRALIS is a thin osseous plate projecting into the spiral canal from the modiulus reaching half way across the spiral canal. It winds around the modiulus and ends near the apex in a hook-like process (the hamulus). Helicotrema is the deficiency in the last half turn of the cochlea. The membrana basilaris and the membrana Reissner are two membranes which extend from the free border of the lamina spiralis and are connected with the outer wall of the cochlea. Between them is the scala media (cochlear duct). The scala media divides the spiral canal into three parts, the scala tympani below and the scala vestibuli above, and between these two the scala media. The scala tympani opens into the tympanum at the fenestra rotunda, however, this opening is closed by the membrana secundaria. The scala vestibuli opens into the vestibule. Where these two scalæ communicate with each other at the summit of the cochlea is called the helicotrema.

The membranous labyrinth is situated within the bony labyrinth from which it is separated by the perilymph.

The **utricle** lies partly in the fovea hemielliptica and is a flattened, oblong sac. It is filled with endolymph and communicates with the saccule through a small tube in the aqueductus vestibuli. The membranous semicircular canals open into the utricle by five orifices.

1. **MACULA ACUSTICA UTRICULARIS** is a thickened portion of the walls of the utricle which contain calcareous masses (otoliths) in which are distributed filaments of the vestibular branch of the auditory nerve.

2. **DUCTUS ENDOLYMPHATICUS** which has been previously described.

The **saccule**, which is smaller than the utricle, receives branches of the auditory nerve through the openings in the fovea hemispherica, and these branches end in the thickened part of the wall which is covered with otoliths.

The **membranous semicircular canals** are the same shape as the osseous semicircular canals and are about one-fourth the diameter of the osseous canals. Their enlarged extremities are called ampulla.

The **membranous cochlea** (cochlear duct) (scala media) is a spiral tube enclosed in the spiral canal of the osseous cochlea between the scala vestibuli and the scala tympani. It is filled with endolymph and contains the **organ of Corti** which is a complex arrangement of modified epithelial cells including the rods of Corti and the auditory cells.

BLOOD SUPPLY.—From the auditory artery which enters the internal auditory meatus and divides into branches for the cochlea and vestibule. The veins empty into the internal jugular and into the superior petrosal sinus.

NERVE SUPPLY.—The auditory nerve which is the nerve of special sense of hearing.

LYMPHATICS OF THE INTERNAL EAR end in the tympanic and intracranial lymphatic vessels.

The **superficial mesial origin** of the auditory nerve is from the groove between the olivary and restiform bodies at the lower border of the pons.

The **deep mesial origin** is in the dorsal auditory nucleus, which is on the outer side of the inferior fovea on the floor of the fourth ventricle.

The **superficial lateral origin** of the auditory nerve is from the auditory striæ, and after winding around the upper end of the restiform body joins the mesial root in the groove between the olivary and restiform bodies.

The **deep lateral origin** is from (1) a ganglion of the lateral root, which is situated in this root as it winds around the restiform body, (2) the auditory striæ, (3) the trapezium of the pons, (4) the ventral auditory nucleus. This last nucleus lies in front of the restiform body between the two roots.

The **main trunk** of the auditory nerve now passes into the internal auditory meatus with the facial nerve and the auditory artery. At the bottom of this meatus it comes to the lamina cribrosa, where it divides into the **cochlear branch** and the **vestibular branch**. (Plate CCXXI).

The **cochlear branch** sends branches to the sacculæ, to the ampulla of the posterior semicircular canal, and to the hair cells of the organ of Corti in the membranous cochlea.

The **vestibular branch** has upon it the ganglion of Scarpa, while in the internal auditory meatus it sends branches to the utricle, to the ampulla of the external semicircular canal, to the ampulla of the posterior semicircular canal.

THE PRINCIPAL SALIVARY GLANDS ARE THE PAROTID, SUBMAXILLARY, AND SUBLINGUAL.

The **parotid gland** takes its name from its position which is near the ear. It is about the size of the pinna (auricle) of the external ear, and weighs almost an ounce. It extends from the mastoid process and the angle of the jaw BELOW to the zygoma ABOVE, being immediately in front of the external meatus. This gland is saddled over the ramus of the lower jaw, and has upon its outer surface a few lymphatic nodes, while its inner surface has two processes upon it. One of which extends behind the styloid process of the temporal bone and beneath the mastoid process of the same bone, while the other is in front of the styloid process. The following structures pass through the parotid gland: (1) the external carotid artery which gives off the temporal branch above, the posterior auricular behind, and the internal maxillary internally, also the transverse facial artery which is a branch of the temporal passes through the upper part of the gland, (2) the common trunk formed by the temporal and internal maxillary veins, (3) a branch connecting this trunk with the internal jugular vein, (4) the facial nerve and its branches, (5) branches of the great auricular nerve.

The upper anterior portion of the gland is called *sociæ parotidis*. This portion is often detached from the rest of the gland.

The **duct of this gland** is about two and one-half inches long. It is called Stenson's or Steno's duct. After crossing the Masseter muscle and passing into the substance of the Buccinator muscle this duct opens upon the inner sur-

face of the cheek by a small opening opposite the second malar tooth of the upper jaw. This duct is about the size of a crow-quill. It has an external or fibrous coat, which contains contractile fibers, and an internal or mucous coat, which is lined with short columnar epithelium.

BLOOD SUPPLY.—From branches of the external carotid artery.

NERVE SUPPLY.—(1) sympathetic from the carotid artery, (2) the fifth nerve (auriculo-temporal), (3) the seventh nerve, (4) the great auricular (cervical plexus).

The **submaxillary gland** which weighs about two drachms is situated in the anterior part of the submaxillary triangle of the neck below the mylo-hyoid ridge of the inferior maxillary bone. The stylo-maxillary ligament separates this gland from the parotid gland, and the Mylo-hyoid muscle separates it from the sublingual gland.

The **duct of this gland** (Wharton's) is about two inches long and opens at the side of the frænum linguæ.

BLOOD SUPPLY.—From the facial and lingual arteries.

NERVE SUPPLY.—(1) sympathetic, (2) the fifth nerve (submaxillary), (3) the seventh nerve (chorda tympani).

The **sublingual gland** weighs about a drachm and is situated at the side of the frænum linguæ in a fossa above the mylo-hyoid ridge of the lower jaw close to the symphysis.

The **duct of this gland** is called the Bartholin or Rivinus.

This duct opens into the duct of the submaxillary gland near its termination.

BLOOD SUPPLY.—From the sublingual and submental arteries.

NERVE SUPPLY.—(1) Sympathetic, (2) the fifth (gustatory).

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ORIGIN.—From the Occipito-frontalis aponeurosis.

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ATTRAHENS AUREM.—

ORIGIN.—From the cranial aponeurosis.

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INSERTION.—Into the skin at the end of nose.

ACTION.—To dilate the nostril.

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INFERIOR LINGUALIS.—Hypoglossal nerve.....Page 551

SUPERIOR LINGUALIS lies near the upper surface of the tongue passing from base to apex. Its action is to shorten the tongue and make it concave longitudinally.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Same as tongue.

TRANSVERSE LINGUALIS runs from the median raphe of the tongue to the dorsum and margin. Its action is to increase the length of the tongue, at the same time make it narrow.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Same as tongue.

VERTICAL LINGUALIS consists of fasciculi which pass from the dorsum of the tongue to its under surface. Its action is to make the tongue flat and broad.

NERVE SUPPLY.—Hypoglossal.

BLOOD SUPPLY.—Same as tongue.

PALATO-GLOSSUS.—

ORIGIN.—From the median line of the soft palate and from its fellow of the opposite side.

INSERTION.—Into the side and dorsum of the tongue.

ACTION.—It constricts the fauces and elevates the tongue, also pulls down the velum.

NERVE SUPPLY.—Internal branch of spinal accessory through the pharyngeal plexus.

BLOOD SUPPLY.—

Muscles of the Pharynx.**CONSTRUCTOR INFERIOR.—**

ORIGIN.—From the cricoid and thyroid cartilages.

INSERTION.—Into the fibrous raphe of the pharynx.

ACTION.—It compresses the pharynx and lifts it upward and backward.

NERVE SUPPLY.—Pharyngeal plexus and inferior laryngeal.

BLOOD SUPPLY.—Same as pharynx which is given on page 315.

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PALATO-PHARYNGEUS.—

ORIGIN.—From the soft palate by two heads near the median line.

INSERTION.—Into the side of the pharynx and posterior border of thyroid cartilage. It joins the Stylo-pharyngeus muscle.

ACTION.—Constricts the fauces and elevates the larynx and tongue, and closes the posterior nares.

NERVE SUPPLY.—Internal branch of spinal accessory through the pharyngeal plexus.

BLOOD SUPPLY.—Same as pharynx. Page 315.

Muscles of the Soft Palate.

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PALATO-PHARYNGEUS, which has been described with the muscles of the pharynx.

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RECTUS CAPITIS ANTICUS MINOR.—First cervical and loop between it and second cervical nerve.....Page 514

RECTUS CAPITIS LATERALIS.—First cervical and a loop between it and second cervical nerve.....Page 514

LONGUS COLLI.—DESCRIPTION.—This muscle consists of three portions,

(a) a longitudinal portion, (b) a superior oblique portion, (c) inferior oblique portion.

Origin of the longitudinal portion is from the bodies of the first, second, and third dorsal, and of the sixth and seventh cervical vertebræ.

Insertion of this portion into the body of the second, third, and fourth cervical vertebræ.

Origin of superior oblique portion is from the anterior tubercle of the transverse processes of the third, fourth, and fifth cervical vertebræ.

Insertion of this portion into the anterior tubercle of atlas.

Origin of inferior oblique portion is from the bodies of the first, second, and third thoracic vertebræ.

Insertion of this portion is into the anterior tubercle of the transverse processes of the fifth and sixth cervical vertebræ.

ACTION.—To flex the cervical portion of the spinal column, and rotates it.

NERVE SUPPLY.—Anterior branches of the lower cervical before they go into the brachial plexus

BLOOD SUPPLY.—

Muscles of the Lateral Vertebral Region.

SCALENUS ANTICUS.—

ORIGIN.—From the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebræ.

INSERTION.—Into the tubercle on the inner and upper surface of the first rib in front of the subclavian artery.

ACTION.—It flexes the neck and elevates the first rib.

NERVE SUPPLY.—Anterior primary branches of the fourth, fifth, and sixth cervical nerves.

BLOOD SUPPLY.—

SCALENUS MEDIUS.—DESCRIPTION.—Is the largest of the Scaleni muscles and passing through its substance is the posterior thoracic or long thoracic nerve.

ORIGIN.—From the posterior tubercles of the transverse processes of the lower six cervical vertebræ.

INSERTION.—Into the upper surface of the first rib behind the groove for the subclavian artery.

ACTION.—It flexes the cervical portion of the spinal column and elevates the first rib.

NERVE SUPPLY.—From the posterior primary branches of the cervical nerves.

BLOOD SUPPLY.—

SCALENUS POSTICUS.—DESCRIPTION.—This is the smallest and deepest of the Scaleni muscles and sometimes blends with the Scalenus medius.

ORIGIN.—From the posterior tubercle of the transverse processes of the lower two or three cervical vertebræ.

INSERTION.—Into the outer surface of the second rib behind the origin of the Serratus magnus.

ACTION.—It flexes the cervical vertebræ laterally and raises the first rib.

NERVE SUPPLY.—From the lower three cervical nerves.

BLOOD SUPPLY.—

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- ARYTENO-EPIGLOTTIDEUS SUPERIOR.—Recurrent laryngeal nerve Page 252
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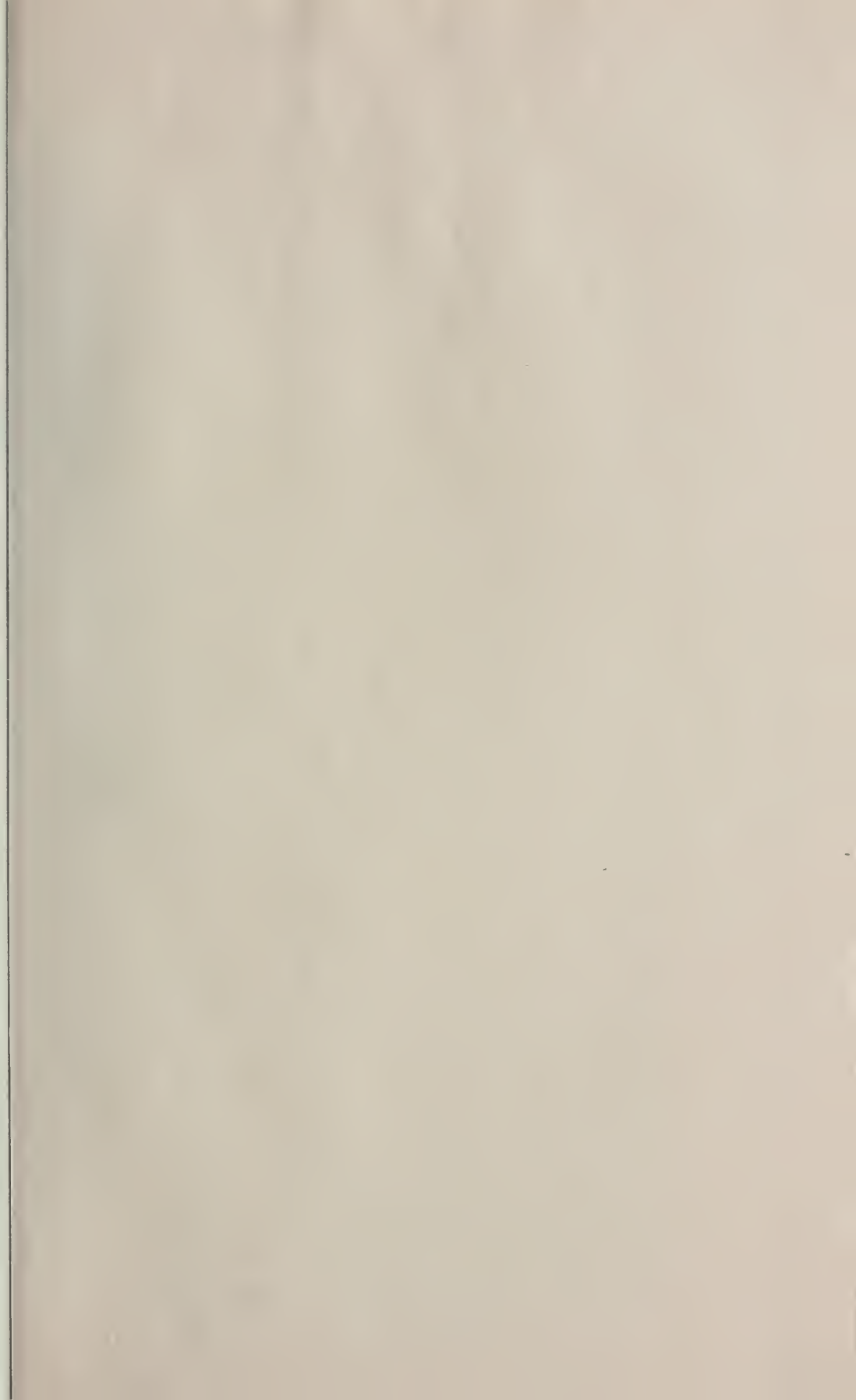
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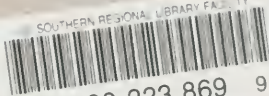




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